THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVII. No. 1968.] LONDON, JANUARY 29, 1901. [53RD YEAR. PRICE 6d.

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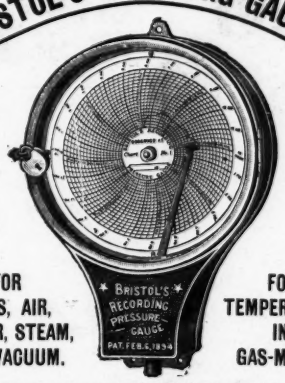

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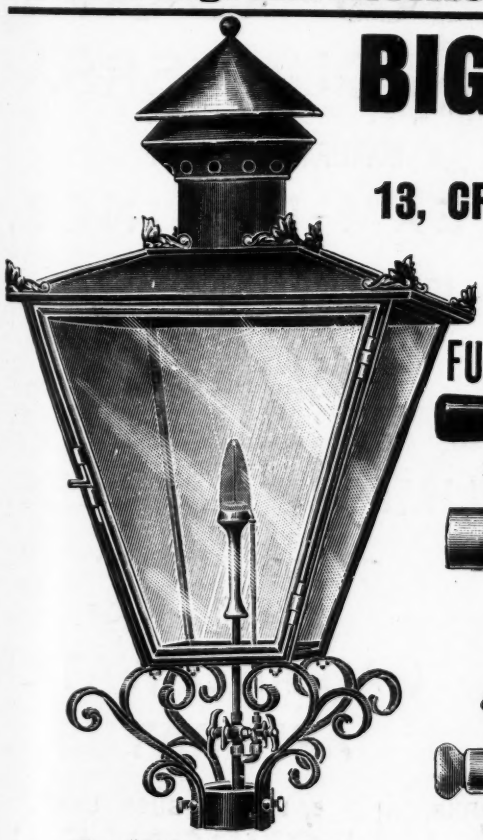

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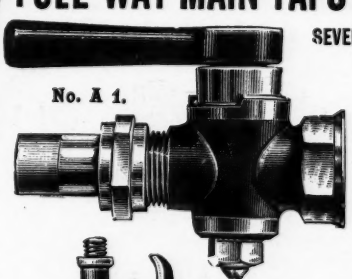

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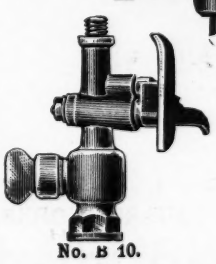
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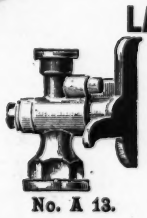
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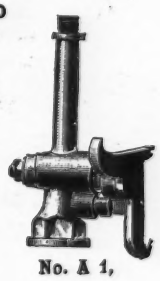
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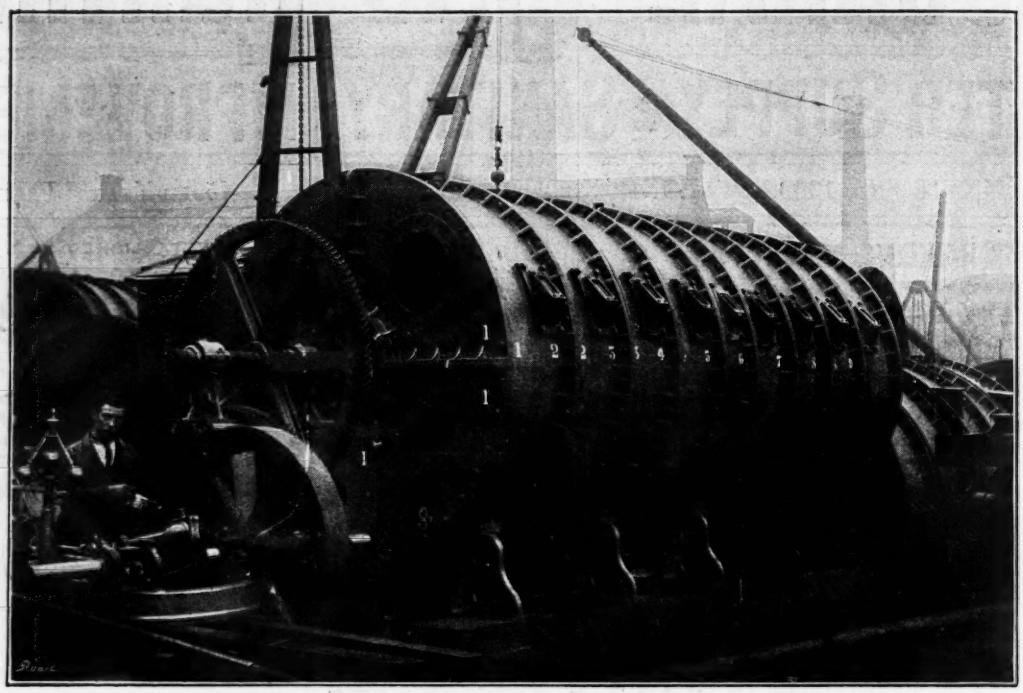

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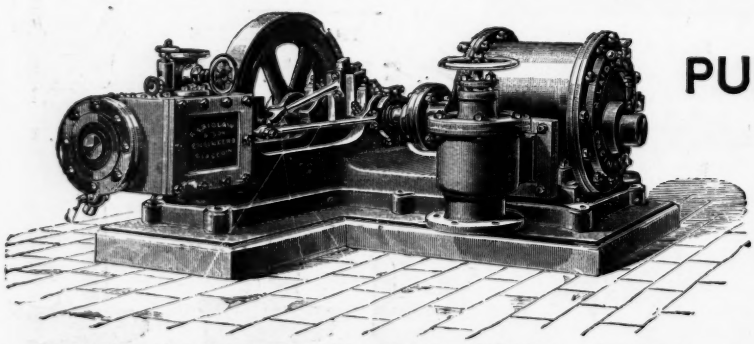

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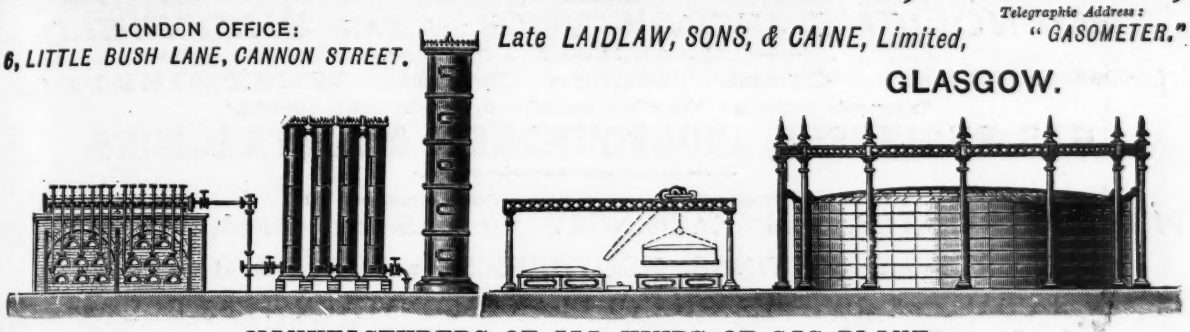

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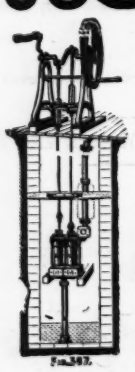

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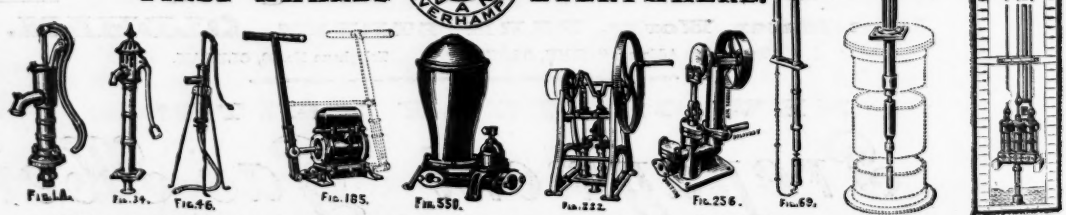

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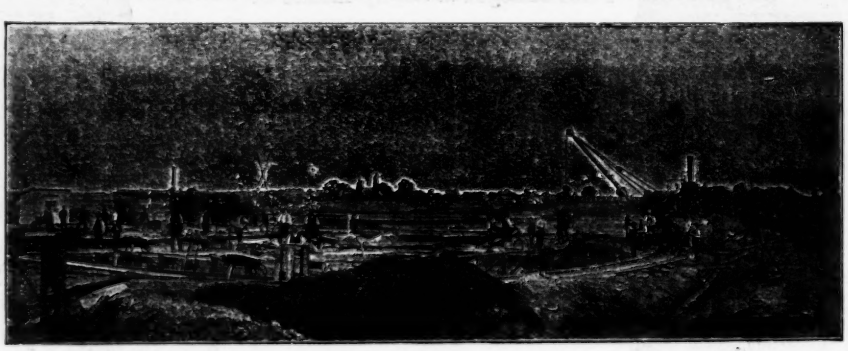

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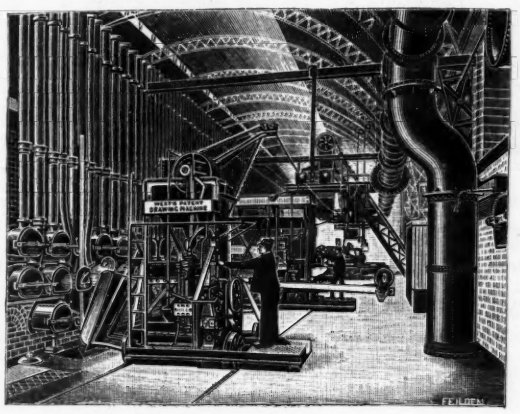

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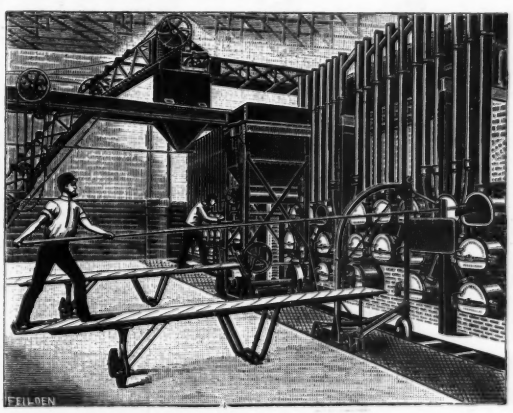

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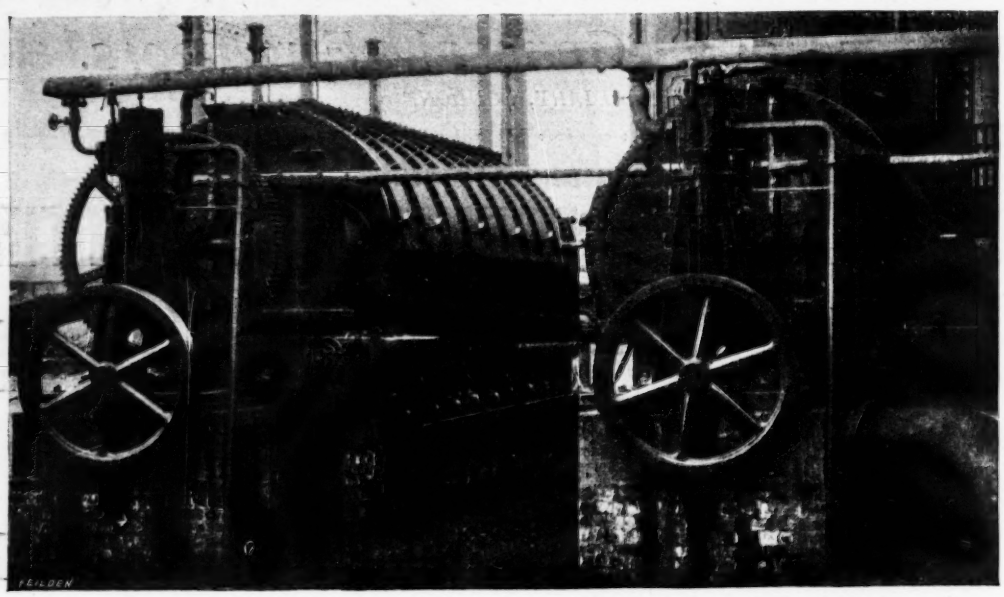

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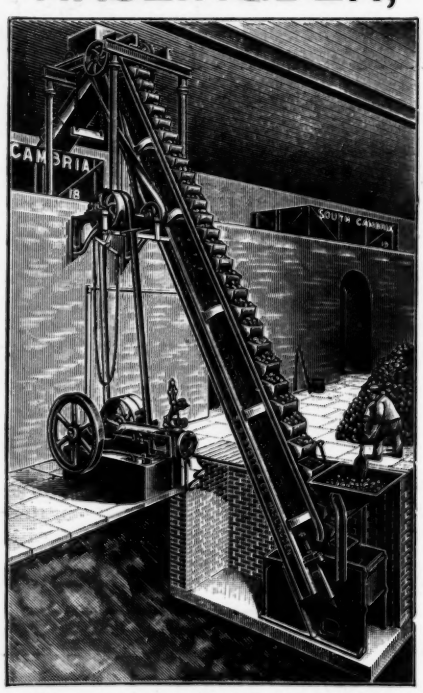

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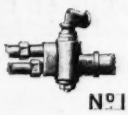

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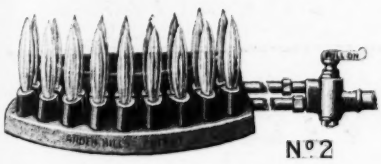

No 2

No 3

No 4

No. 1. Tap off.
No. 2. Burner and Tap full on.
No. 3. Showing position of Lever in Tap when three quarter on.
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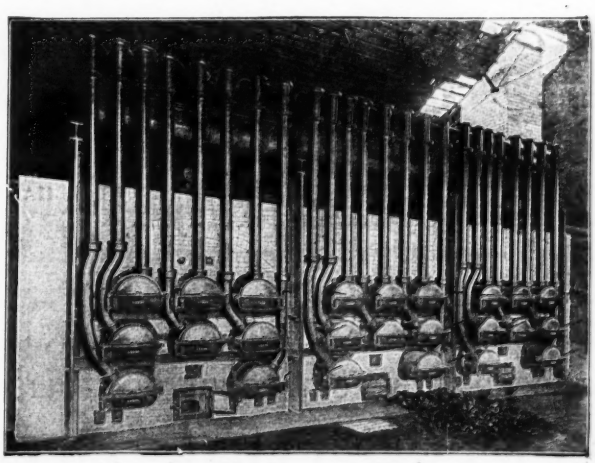

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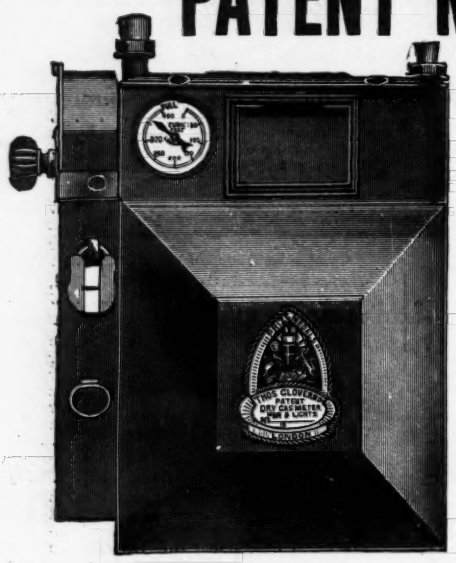

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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VICTORIA: QUEEN AND EMPRESS.

ALTHOUGH of necessity belated, it would be unseemly for the "JOURNAL" to appear for the first time after the death of Her Majesty Queen Victoria—of blessed, happy, and glorious memory—without an acknowledgment of the loss which the British Empire has sustained in the mournful event of this day week. It is not our usual task to dilate upon these high matters; but just as no Public Body or Institution of English-speaking people can meet in the shadow of so great bereavement without testifying to their sense of its bearing upon themselves, so we feel it a duty to consecrate the first place in our pages to-day to the briefest record of the departure from this world of incomparably the most august Figure in it, who was our Beloved Queen. And at the same time—since there is no halt in the march of human affairs—let us take the opportunity for hailing the accession to the Throne of these realms of King Edward the Seventh, under whom there is already the happiest promise that the progress and development of the British People in all the Arts, Sciences, and Occupations that tend to make a Nation great, prosperous, and progressive, will be not less favoured—in all that lies within his power to influence or command—than was the experience of the United Kingdom of Great Britain and Ireland during the ever-memorable reign of His Majesty's Illustrious Mother, now in God's Peace.

EDITORIAL NOTES.

Coal and Coke.

THE fact that the prospects of the coal trade are by no means so rosy as coalowners would wish, appears to have at length been realized by local correspondents of the trade journals. It has in all probability been known to them for some time past; but many of them have previously affected to regard any slackness in the market as but of a temporary character, certain to disappear (like a bad dream at morning) upon the first sign of winter weather. They naturally put the best face upon things—it is not their business to cry "stinking "fish," as the homely phrase has it—so that when, as now, they with virtually one accord begin to speak pessimistically, there can be no question that the trade is alive to the fact that the downward road lies ahead. The market "is quieter;" "complaints of lack of trade are becoming more frequent as "well as proceeding from a wider area;" the trade "does "not improve," "is in an unsettled state;" "there is an ab-"sence of inquiry;" the outlook is "in no sense satisfactory," "scarcely altogether satisfactory;" and so forth.

Gas coal is, in fact, quoted 1s. per ton lower—at about 11s. 6d. f.o.b. Tyne; and, as our readers know full well, between the quoted price and the real price at which it is possible to buy there is usually, and invariably at the present time, a margin. We hope that no gas undertaking will lightly enter into any contract for future delivery at the price just named, which is 5s. per ton above the normal figure. As we have said before and would urge again, there is no need for anxiety about future supplies. The output is now fully equal to the demand; and the tendency is for the one to increase and the other to diminish. The risk involved in hand-to-mouth buying until the collieries are willing to offer reasonable terms for future supplies is not very great. The only source from which the occasion of a shortage of supplies is to be feared is the spirit animating the highly paid miner; and labour troubles are more likely to come after than before the price of coal has been shaken down to a level at which consumers would feel disposed to buy. There is plenty of gas coal in the market at present. One at least of the Metropolitan Companies is literally turning coal away from the works; while buyers generally are finding it more and more easy to get prompt delivery. Of course, a spell of really severe weather—and we can never reckon upon having seen the worst of the winter until we have said good-bye to February and March—would give a fillip to the market, and would send prices up again. But there would be nothing to be alarmed at in that. It could be only a temporary spurt, affecting not in the least the real situation; for it certainly could not bring back any real animation to the drooping iron trade.

Reports from the great centres of the iron industry grow gloomier every week. In spite of reduced prices and restricted output, orders do not come forward in sufficient volume to replace those executed; and the industries that were at this time last year in the full enjoyment of unparalleled prosperity and activity, are now suffering from severe reaction and depression. The recently-formed combination of Cleveland ironmasters has speedily come to an end; the members finding it necessary to take orders on just such terms as they can get. Combinations designed to maintain price are destined to failure if they do not possess the means of effectively controlling the market; and to control the iron market at present, without killing it, does not appear possible. The consumption of coke by the iron and steel trades is steadily diminishing; and this is having its

effect on the coal and coke markets—more immediately and markedly on the latter, but no less surely on the former.

The coke trade is undoubtedly suffering severely from the industrial reaction combined with the mild weather, and the throwing upon the market of considerable quantities at low prices by holders of unsold stocks is having a disorganizing effect. The situation requires skilful handling, or not only will prices be unduly depressed, but unnecessary hardship will be imposed upon customers who entered into engagements at top prices, and who are open to the competition of others who can now buy in the market at very much lower rates. Those who bought at the higher price did so, of course, with their eyes open; but the vendors may well bear in mind the proverb (the coalowners now appear to have quite forgotten it) which points to the folly of killing the goose that lays the golden eggs. A broad mind, a clear head, and a grip of the essential facts are at the present moment more than ever the needful qualifications for those who have coke to sell—or have sold it and find contractors far from hungry.

To return to coal. We would end as we began by emphasizing the wisdom of a cautious policy in regard to future contracts. It is good to observe that buyers generally are following the course of refusing to play the owners' game, and with encouraging result. "The continued holding back "of the usual large contracts does not," we read, "tend to "improve the position" in the coal trade—from the sellers' point of view. From the buyers' point of view it is very satisfactory; and we hope their nerves will prove equal to lasting out those of the colliery proprietors. A mutual understanding between the conductors of the principal gas-works as to the course to be followed during the coming two or three months might be very helpful.

The Position of Public Street Lights.

An interesting discussion on central *versus* side-walk street lighting took place at the last meeting of the Glasgow Corporation, upon a minute of the Watching and Lighting Committee relating to the electric arc lighting of Great Western Road, from Kelvin Bridge to Hyndland. The rails and trolley-wire poles for an electric tramway are installed in the roadway; and the Corporation Gas Engineer, the Electrical Engineer, and the Superintendent of Lighting had been asked severally to report as to the best means of lighting the thoroughfare. This was a very proper course to take. It has not transpired whether these reports agreed in all points; but Mr. Primrose, in moving the approval of the Committee's minutes, stated that Mr. Foulis, Mr. Chamen, and Mr. Hamilton were united in the opinion that the road would be better lit from the sides than from the centre. In view of this statement, the Committee wished the Tramway Committee to bear the point in mind in any future operations; but meanwhile, as the electric traction poles were actually fixed in the middle of the Great Western Road, they judged it expedient that they should be utilized as posts for arc lamps. Accordingly, the Committee recommended that 50 arc lamps of 7-ampere type, costing £670 per annum, should be put up in the road. In the course of the discussion of this recommendation, which was met with a motion for its rejection in favour of a scheme of side lighting, several councillors showed a commendable degree of knowledge of the principles of street lighting. Unfortunately, those who desired a settlement of the question in the interest of good lighting were handicapped by the circumstance of the central poles being actually in position. This fact was a strong argument on the side of those members of the Corporation who saw an objection to tearing up the roadway again, and so forth; and eventually the central lighting was approved of. Not only so, but the portion of the minutes of the Committee which expressed the opinion that side lights are the most satisfactory method of lighting, and afford the best means of diffusing and distributing light, was ordered to be taken back.

It is to be hoped that the Glasgow Corporation have not heard the last of this important question, but that the reasoned opinions of the three experts on the subject whom the two Committees have already consulted will be put forward with all due authority for the guidance of the Tramways Committee in the future. Of course, every street lighting expert must be allowed to cry the merits of his own special kind of "leather." Mr. Foulis can do no other than claim superiority for gas; while his colleague of the electrical service will commend arc lamps. But this does not at all affect the present question, which is simply and solely as to the best situation for the lights, whatever their nature. There is a qualifying consideration of a preliminary order even here—which is the power of the lights. It is to be assumed that the lights will, in any case, be of approximately equal illuminating power, and that a fairly high one. Now, the 7-ampere arc light is not a particularly powerful source, as modern lights go. If we allow it an average intensity of 500 candles, it will be to flatter it. Even so, Mr. Foulis could beat it easily at less than one-half the estimated cost of £13 8s. per lamp per annum. But this by the way. What we started to show is, that it is only high-power lamps that could be thought of in connection with central road lighting. Small, ordinary street-lamps of old-fashioned style, giving a light of about 12-candle power, could never be used in this position. The first central road-lamps everywhere were "refuge" lights, intended to facilitate the traffic at busy crossings; and they were always of high power. For this purpose, central lights are indispensable; but that is a very different matter from the later suggestion to place all street-lamps in the middle of the road, which is a mistake.

Central road-lamps, to be brief, are only correct when they are really intended and needed to serve the purpose of "refuge" lights—that is, when the thoroughfare is very wide, very crowded, and where every lamp proclaims the existence of a practicable crossing. It is both easy and safe to walk towards a light, but it is another matter to walk away from a light, especially a powerful one. Therefore, a street "refuge" light is likely to prove worse than useless, unless on leaving its friendly shelter the wayfarer finds another light fronting him on the side-walk for which he is making. Bailie D. M. Stevenson is reported to have asserted at the meeting of the Corporation that in all Continental cities central street lighting is being adopted. He is misinformed; or at least his information does not extend far enough to acquaint him that, in all places where the street lighting is scientifically done, central lights are never used in Continental practice without adequate side lighting at the same time. But, in truth, the question can be answered by the Scottish method of asking another: What are streets for? If the foot traffic went down the middle, then central lights would suit everybody's convenience. As it is, however, central lights alone are useless to foot passengers, whether walking along the side-paths, crossing the road, or seeking to read the lettering on their side of a passing tramcar or omnibus. They must also, in this case, enter and leave all cabs on the dark side; and carmen can never have the assistance of the public lamps. A bolting pickpocket has only to dart across the road under a central lamp to be instantly swallowed up in the darkness on the other side.

The Zurich Gas-Works.

With the present issue of the "Journal" is completed the series of illustrated articles descriptive of the new gas-works at Schlieren, Zurich, with which the current volume began. The educational value of such a unique mass of technical matter of the highest quality can scarcely be overrated; and it is to be supposed that this magnificent exposition of what gas engineering means for the technicians of Middle Europe has opened the eyes of many an English gas director and corporation committeeman. It is only necessary to look back a few years, to the period when the earlier chapters of "King's Treatise" were running through the "Journal," to be struck with the enormous difference between the simplicity of the retort-house practice of that day, and that represented in this most elaborate set of plans. We shall not attempt to criticize the Zurich designs, either as a whole or in detail. Such an exercise might be profitably undertaken by some competent hand as a technical society paper. It would be interesting to have this done, if only with the object of placing in comparison, not necessarily for competition, the different points of view occupied, and conditions experienced, by British and Continental gas engineers, and their respective results on practice. For the present, we prefer to leave the subject with an expression of thanks to our esteemed friends at Zurich for the facilities they have so freely afforded for the publication of an account of their work in English; and if it should ever come within our power to return the kindness, we hope to prove not unmindful of the obligation to do so. This is the true Internationalism which has survived among the followers of science, of all nations and tongues, since the days of Erasmus; and it never bore any better fruit than it does at the present time for the expert technicians who are the real successors of the wandering scholars of an older era.

The One Unliquefied Gas of the Century.

In nothing can the substantial advancement of physical science during the past century be more distinctly seen than in the scientific treatment of gases. As a popular reviewer has recently remarked, the last century was in a notable way an Age of Gas-Light; but it was also an Age of Gases, in a very much wider sense. It fell to Professor Dewar to sustain this thesis at the first Friday evening meeting of the Royal Institution for the season; and it was only due to a series of mishaps to the necessary apparatus that the lecturer was precluded from starting the new century's teaching as to the nature and properties of gases with an exhibition of the effects which are producible on matter in the gaseous form by the liberal application of liquid hydrogen. The suspicion that the gaseous state of matter might be only an effect of temperature and pressure, was entertained by Dalton so early as the year 1802; and it is interesting to be reminded that Davy, who adopted this view, fell into the error that liquid gases could be advantageously used for the provision of motive power. The same mistake is still committed to-day, with less excuse, by persons who wholly mistake the constitution of liquid air. The theory of the liquefaction of gases was laid down by Andrews, to whom the world owes the discovery of the critical temperature of gaseous bodies, which put Dalton's supposition upon the basis of fact. In concluding his lecture, Professor Dewar described the latest discoveries effected by the application of liquid hydrogen to air. A number of unsuspected constituents of the earth's atmosphere have recently been detected in this way. Some remarkable results have also been obtained by extending a like treatment to the gas of the Bath springs, which differs from anything in the atmosphere. The mystery is as to where it comes from. The most significant of these strange elements is still helium, which has not yet been obtained pure. Professor Dewar believes that helium might be liquefied, although at great cost, and then it would be possible by its further use to get within 5° of the absolute zero of temperature. Thus the past century, with its record of all the old so-called permanent gases transformed to the liquid and solid states, leaves to the new one the problem of the liquefaction of a new gas, helium, with all the results that may flow from its successful solution.

Collapse of the Lightermen's Strike—Taff Vale Troubles.

The significant statement was published in the London newspapers of Friday last that the strike of lightermen on the Thames, which has lasted for several months, had at last collapsed. Most of the firms affected by the strike have been informed, so the statement runs, that the men in all the different employments will return to work forthwith, on the terms offered by the employers on Oct 20. So ends one of the most vexatious, fruitless, and generally insensate of the "labour troubles" of recent years, which is saying a good deal. Of course, it was supported—theoretically, that is—by several "popular" politicians, and mentioned sympathetically by some of the less reputable newspapers. All the same, after the employers had made their offer of more money and a clearer rule about overtime, the men's agitation had not a leg left to stand upon; and its ignominious collapse is the best commentary upon their officials' valiant delarations of "No surrender." It is a great scandal that any trade should be exposed to interruptions of this kind; but an effectual remedy for the danger seems as far off as ever. There is no agreement of opinion upon the crucial point of whether Trade Unions make more strikes than they prevent, for the reason that there is much good evidence on both sides. The Lightermen's strike, for example, seems to have arisen out of that sheer "cockiness" which most Trade Unions at some period of their career exhibit, in the persons of their officials. So long as this disease (otherwise unfavourably known in America by the name of "swelled head") afflicts the executive of a trade society with money, there is bound to be trouble. Whenever a case of this complaint is clearly diagnosed, as it was during its epidemic year, 1889, when self-constituted Dockers' Leaders patronized Cardinals, but would barely recognize Lord Mayors, the only effective remedy is the lock-out. This specific has been exhibited, as the Faculty say, in many cases since then; and one of the worst sufferers—the Amalgamated Society of Engineers—profess to be all the better for it to-day. Last week we recorded how the very wind of its application brought the Dockers and Gas Workers to a better frame of mind in South Wales. In the case of the lightermen, unhappily for themselves, the cure has dragged out its full length, because the victims were not sufficiently wise to profit by any other strikers' experiences.

One of the latest pieces of evidence adduced by those newspapers which would fain speak well of the peaceable tendency of Trade Unions is the official discouragement of the Taff Vale Railway men's agitation by Mr. Richard Bell, M.P., the Secretary of the Amalgamated Society of Railway Servants. It is scarcely necessary to discuss over again the utterly divergent views of Trade Union ideals and the tendencies commonly taken by benevolent outsiders, and by employers. Only this may now be said—that, whereas the employer regards the Trade Union as, first and last, a militant organization, the outsider prefers to believe its ends to be peaceful, even if its methods are initially warlike. In other words, while the benevolent (and outside) view of a trade society is that merely of a constitutional militia, the employer distrusts it as a standing army, with a General Staff ready to wink at any iniquity rather than see its own selfish interests jeopardized. It is a reproduction, in the world of industry, of the polemic that has disturbed Christendom these hundreds of years, and is far from being done with. The other day, a leading newspaper mentioned that Mr. Bell was discountenancing the Taff Vale men's agitation, which it found quite natural, inasmuch as these officials of trade societies have a paramount interest in keeping the funds of the societies intact, and must therefore hate strikes. This appears the sensible view, truly; but experience does not bear it out. There never was a strike fomenter, from Mr. Ben Tillett or Mr. John Burns down to the most insignificant walking delegate, who did not advertise himself at such times as a martyr to hard work. Even the eclipsed Mr. J. Havelock Wilson was fain to award himself an ovation, or a brass band recital, to keep up his strength for the fray. Yet, somehow, strikes are good for the agitators' trade. The subscriptions never flow in more freely than when there is a sniff of combat in the air. There is even reason to believe that the attentions of newspaper reporters, and the palavers with other eminent busybodies who usually represent the idea of "conciliation" at such stirring times, are not unpleasing to Trade Union magnates; and then, they have the satisfaction that it is all the same to them whether their side wins or loses. It is not they who suffer in pocket or person while the strike entered upon so light-heartedly drags on wearily towards its predestined end.

To return to the case of Mr. Bell and the Taff Vale malcontents, whom he is credited with having discouraged, it now appears that the Committee actually representing the men have defied him to deny that he has known all about their proceedings. So that besides the general action pending between the Railway Company and their old servants over the retention in their service of the emergency hands, there is the prospect of an internecine feud between the Taff Vale branch of the A.S.R.S. and their own Executive. This is how Trade Unionism makes for peace.

More Gas Agitation in London.

There was another meeting on Saturday afternoon of gas consumers in the northern district of the Gaslight and Coke Company, to protest against the difference in the prices of gas north and south of the Thames. The proceedings were of the usual character, and eventuated in nothing more practical than a resolution to ask the Court of Directors of the Company to receive a deputation. This is the ordinary procedure of the residents in localities labouring under what they regard as an unsatisfactory railway service; but it rarely effects any useful purpose. In this case, it would have been more to the point if Mr. James Rowlands and his colleagues had addressed themselves more strictly to the actual circumstances of the Company, and had offered some indication of the opinion they entertain of the suggestions contained in the Company's Bill. It is mere beating of the air to dilate upon the comparatively high price of gas in North London, and to accuse the administration of mismanagement in the past. There is no dispute about this. The only consideration worth discussing is what can best be done now. That money is wanted to enable the Company to fulfil their obligations to the public, cannot be denied. How, and under what conditions, it can safely be entrusted to the Company to raise and lay out, is the *crux* of the present problem. Technicians would very much like to know how the capital has gone since 1876, only to leave the undertaking with a string of works sadly in need of remodelling

and bringing up to date. It would also be interesting to know the rights of the financial aspect of the meter-rent and prepayment branch questions. To ascertain the truth of these and other matters that appear to want clearing up, would necessitate the issue of a Commission of Investigation; and who is to take such a business in hand? Money—that is the Company's need of the hour; and, in order to obtain much less than they have asked for, they have offered to yield very much more than they ever intended.

The Bill, of course, is not the last word on the question. Taking it as a tender of terms, the public authorities and the organized gas consumers should make up their minds as to what else, or further, they would like to have enacted in the public interest. The regular opposition to the Company may, or may not, appear before the Parliamentary Committees with a coherent plan. Possibly the Corporation of the City of London may have a sensible idea or two respecting the subject, although there are some very weak members among those who have displayed an interest in the matter. The London County Council, however, will need to set their house very much more in order than they had it last session, if they are to make any great impression upon Parliament. Mere snarling and general "nastiness" towards a "capitalists' monopoly" will not answer for a policy of opposition. The question remains, therefore, what do these malcontents think of the Company's Bill? Does it go far enough, or what can be hoped for by way of amendment? If thrown out, what will be the consequences? It is to be noticed that the late meeting was not above threatening to "boycott" the Company's gas. That is sheer nonsense. People do not burn gas in order to please the manufacturers, but because it suits their own purposes to make use of the article. Besides, that suggestion means merely sulking, which never benefited anybody yet. Thus we come back to the subject of the Bill, and what Parliament is to be asked to do about it. We have already recorded our own opinion of this measure, but should like to hear how the public are disposed towards it. Why does not Mr. Alpheus Cleophas Morton call a meeting on his own initiative, and explain the actual position? There will be nothing gained by cherishing some secret plan of campaign, to be sprung upon the promoters in Committee. The Bill discloses the Company's hand, for all to see; and if there is to be any force in the opposition to its provisions, the reasons for it ought to be spread abroad as widely as possible.

The Example of Others.

A SERIES of interesting articles, written in a light, chatty vein, has been prepared by Mr. E. W. T. Richmond for publication in the "JOURNAL;" and the first appears to-day. The communications are founded on notes made and material collected by the author during a recent visit to America; and having had an opportunity of reading the complete series, we are in a position to say that they contain many points which may be useful here in England. Mr. Richmond stepped on to American soil as a business man; and through the glasses of a business man he took stock of all that he saw connected with the gas industry of the country. He has returned with the strong conviction that American Gas Companies are far more energetic in developing the day consumption of gas than are English Companies; and it will be found that this is not a mere notion formed by superficial observation, but is grounded on figures—some of them surprising—which he went straight to headquarters to obtain. Of the methods which have brought about the realization of large patronage in the stove branch of the American gas business, Mr. Richmond has much to say; and he holds the belief that, by the fusion of those methods with our own at home, a big expansion of the day consumption of gas may be acquired in this country. Admittedly they do these things thoroughly in America; and we of Great Britain should not be too proud to take leaves out of their book, in order to secure like results. But tastes differ in different countries; and things that might bring custom in one might drive it away in another. On the whole, however, in the matter of advertisement, the circulation of literature, and personal canvass, English managers might with advantage follow a long way on the lines of their American cousins, as well as in the individual education of consumers in the proper use of gas appliances after they have been placed. What some of the American Companies have done in the matter of stoves, has been accomplished in England in respect of prepayment meters; but that is no reason why we should not try to equal them in the former branch of the business. The articles present other topics for consideration; but the one here mentioned is the chief.

Speakers at Technical Association Meetings.

THERE is one aspect of the conduct of meetings of some of our bodies of professional men in which an improvement might be effected, and that is in the position occupied by the members when taking part in technical discussions The Gas Institute, the Institution of Gas Engineers, and the District Associations are all behind certain societies of other professions in the mode of managing their discussions. At gatherings of gas engineers and managers, members pop up here and there, irrespective of their situation in the meeting rooms, and address the other members. If the speaker happens to be sitting quite at the rear of the room, he talks to the backs of his fellows, whose acoustic organs may not be so constructed, or are not always of that high order, that they can obtain possession of all that is uttered behind them. Or if the speaker happens to be seated in a front row, he defers to the President by addressing him; and he leaves the rank and file, who are just as keenly interested in hearing what he has to say, to catch as much as they can of his remarks. In either case, the speakers occupy positions behind the "recording angels" upon whom so much always depends in the way of faithfulness of report. The room in which the Southern Association usually meets at the Holborn Restaurant has a particularly bad character in this respect. A speaker sitting quite at the back is very indifferently heard, and added to the unsuitability of the room for speaking from any point far removed from another is the distressing noise caused by the hurry-skurry of the hotel attendants in making preparations for dinners and teas in adjoining rooms, and looking after their other duties—not to mention the buzz of the traffic outside. To overcome all these difficulties, our professional organizations might with benefit to all at the meetings emulate such Societies as the Surveyors' Institution and the Institution of Mechanical Engineers (whose meetings we have recently had occasion to report), who have a much superior way of conducting their discussions. They insist that the speakers shall step up to the President's table, and from there address the meeting. If a man has anything worth saying, he cannot object to this; and it has a threefold advantage: He is near the President, who is able to hear him; he faces the audience, who have a better chance of learning what he has to say; and he is near the reporters, who are then able to secure an accurate record. In this way, if the speaker is not blessed with a good penetrating voice, his remarks are not altogether lost to his fellows and to posterity; and if a member suffers from defective hearing, knowing the position in which the speakers will stand, he can take care that he is in attendance at the meeting soon enough to secure a "front seat." In the Institutions named, it is not found that the arrangement wastes an appreciable amount of time; and, even if it did occasion a little loss, five intelligible speeches are much better than six only partly heard. Let the Committees of the technical bodies connected with the gas industry think over this point of meeting management, as, speaking from experience, we know its real advantages.

Societe Technique du Gaz en France.—Notices signed by M. Alfred Lebon, the President of the Society, have just been issued announcing the date of this year's congress. It is to be held at Dieppe on the 17th of July and following days. Candidates for the awards for competitive theses are reminded that the 1st of March is the latest date for their delivery. Authors of papers to be read at the meeting are requested to send in their contributions as much before the 17th of June as possible. The information is added that, owing to the importance of the minutes of proceedings of last year's International Gas Congress, the volume of "Transactions" will not be ready before March.

The London County Council and the Water Companies' Regulations.—Owing to the death of the Queen, the conference of representatives of Metropolitan Borough Councils convened by the London County Council for last Friday, to consider the new regulations proposed by the Water Companies, has been postponed till next Monday. In view of this conference, and of the inquiry by the Local Government Board to be held on the 11th prox., the Water and Public Health Committees of the Council have prepared a joint report, which occupies 16 pages of the *agenda* for the meeting to-day. The Committees examine in detail all the proposed changes, which are giving rise to a great deal of opposition from the Local Authorities; and the official inquiry will therefore be of considerable importance. Our contemporary the "Builder" has, in the current issue, opened an attack upon the Companies, who, it seems to us, are only taking the necessary steps to prevent the great waste of water which goes on in the Metropolis.

WATER AFFAIRS.

An Abortive Attack on the London Water Supply.

It is scarcely necessary to recall here, at any length, the circumstances which led to the passing of the Metropolis Water Act of 1897. Severe frosts, and other unusual meteorological conditions, had interfered with the regularity of the water service, and had given rise to agitations against those responsible for it. Accordingly, the Government introduced and carried a Bill authorizing any local body or individual consumer to lodge with the Railway and Canal Commissioners a complaint if a Water Company failed to perform some statutory duty; and if the parties satisfied this tribunal that there was good ground for their complaint, a penalty might be imposed. Judging from the outcry raised before the Government took action, one would have supposed that their Bill was so urgently needed that as soon as it became law the Commissioners would be overwhelmed with complaints. But, as a matter of fact, they were not troubled for more than a year after the passing of the Act, and then only to adjudicate upon the decision of a Registrar (which they confirmed) to disallow nearly five hundred interrogatories put in an action taken by the Hackney Vestry against the East London Water Company, for failure to keep up a constant supply during a time of severe drought. Last week, however, as will be seen by our "Legal Intel-"ligence," they had to deal with complaints against the Southwark and Vauxhall and Lambeth Companies. The original movers in this matter were the Vestry of St. Mary, Battersea; but the proceedings were continued by the Borough Council. The ground of complaint was that the water supplied for domestic use on many occasions was not efficiently filtered, and not "pure and wholesome" within the meaning of the statute. Since June, 1892, some five-and-forty samples had been analyzed for the Vestry, with the result that nine were condemned as "unfit for use," and four were characterized as "very inferior," and liable to cause typhoid fever, diarrhœa, and other diseases which are commonly supposed to be propagated by impure water. The first-named disease had appeared in Battersea; and it was sought to connect the outbreaks with the supply of this water. To discuss analyses taken over a period of eight years appeared to the Commissioners to be scarcely necessary; and at the suggestion of Mr. Justice Wright, who sat with them, the investigation was confined to what had happened since the year 1896.

The whole question, as will be seen from the full report which appears elsewhere, turned upon the analyses which had been made of the water on behalf of the respective parties. The samples condemned as bad were taken when the river was in flood, at which time, according to the allegations of the complainants, it contained an undue proportion of albuminoid ammonia or nitrogenous polluting matter. Mr. Cassal, the Public Analyst of Kensington, went at some length into the analyses he had made, and stated that the ground of his complaint was the insufficient purification of the water. This he considered should be improved, and the pollution of the river prevented. He condemned a sewage-contaminated stream as a source of supply, whatever process of purification was applied; but at the same time he thought that the water could be so efficiently treated as to be made fit for consumption. He practically admitted that the Company were now actually doing this, for from December, 1898, down to the end of 1900 he did not absolutely condemn any sample of water; his monthly reports for last year being marked "fair" or "tolerably "fair." Dr. Corfield, who supported Mr. Cassal, attributed certain outbreaks of typhoid fever to imperfectly filtered water; but he could not point to any town, in which the filtration process was the same as in London, where such an outbreak had been traced to the water. Dr. Hewitt, an eminent bacteriologist, confessed that he had never found the typhoid bacillus in water, though he had often tried to do so; and he thought that if the result of filtration was to remove from 99 to 100 per cent. of the bacteria, the probability was that any injurious species would go with the rest. Sir Charles Cameron, of Dublin, while supporting Mr. Cassal, had to acknowledge that, though the city on the Liffey suffers heavily from typhoid, no one there attributes it to the water supply, which is one of the best in the world. Dr. Wynter Blyth and Mr. Cecil Cribb also gave evidence on behalf of the complainants; the former expressing his distrust of bacteriological examinations of water, and the latter attaching little importance to them. At the same time, he said that if he found pathogenic germs in water before filtration, and none after, he should be satisfied that the operation was perfect. This closed the case—and a very weak one, as we venture to think—against the Company.

Mr. J. W. Restler, the Company's Engineer, opened their case by giving particulars as to the capacity of the reservoirs, the areas of the filter-beds, and the average rate of filtration at various periods from 1894 to the present time. He said the storage had been augmented from 46 million gallons in the year named to 436 millions now, and that contracts had been entered into for a further 1070 millions; while the filters had been increased from 18 to 25, with more to follow, and the rate of filtration gradually brought down to 1·36 gallons per square foot per hour. He was followed by Sir William Crookes, whose valuable rebutting evidence was interrupted by Mr. Justice Wright remarking that all the Court wished to know was whether the water supplied by the Company answered the description of "pure," or whether there was any defect in their method of filtration. This was a plain and straightforward question; and it brought an unequivocal answer. Sir William said there was no doubt whatever that the water was pure and wholesome, and that the Company's system of filtration was good. He added that, in his opinion, typhoid disease in London had nothing whatever to do with the water supply; the death-rate in the Metropolis being much lower than it was in the other principal towns. As for pathogenic bacteria, an enormous number of them would be required to do any harm. The standard of 100 microbes per cubic centimetre had been adopted simply as a guide; but as the Companies were working better, they "tightened the screw." He pinned his faith to the bacteriological test as the only effective one under all conditions.

The evidence of Sir W. Crookes really answered the complaint; but his colleague—Professor Dewar—and Dr. Percy F. Frankland were called to support him. Both of these witnesses agreed that Thames water, if properly filtered, is perfectly wholesome; and the analyses showed that the filtration had been good. The Court were so satisfied with this evidence that they did not trouble the Company's Counsel, Mr. Claude Baggallay; and Mr. Cripps, for the complainants, admitted that he could not ask for any order going beyond what the Company are proceeding to do. At the same time, he submitted that the Vestry were justified in making the application. Mr. Justice Wright quite agreed with this. He pointed out, however, that the Company were now voluntarily carrying out the very works which, if the Court could do it, they would order—in fact, were probably doing more than the Court would be inclined, under any circumstances, to order. The application must therefore be dismissed; but as there was apparent ground for the complaint, the order would be made without costs. Under these circumstances, the case against the Lambeth Company was not gone into. It would, perhaps, be unfair on our part, after the expressed opinion of the Court, to say that the proceedings were altogether uncalled for; but we are quite justified in claiming as their result a vindication of the character of London water, and a judicial acknowledgment that everything possible is being done to maintain and improve it.

Masonic.—On Tuesday, the 15th inst., Mr. B. Ely, Engineer of the Riddings District Gas Company, was elected W.M. of the Royal Alfred Lodge, No. 1028.

Local Government Annual, 1901.—We have received from the office of the "Local Government Journal" the tenth issue of the above-named "Annual." The directory portion of the book has been amplified, and now furnishes ready means of reference to the several branches of local government. In it will be found the names and addresses of the chief officials of all Corporations, London Borough Councils, County Councils, Boards of Guardians, Urban and Rural District Councils, County and Borough Asylums &c., throughout the kingdom, as well as the public libraries, public parks, and City Companies of London. Information is furnished relative to the public libraries, baths and washhouses, and electric light undertakings in the boroughs of London; and there is an abstract of the Local Government legislation of 1900. The list of the Gas and Water Companies in London has undergone needful revision; but there are still one or two blemishes. Absolute accuracy is rarely, if ever, attainable in a work of this character, partly owing to the exigencies of printing; but the Editor (Mr. S. Edgecumbe-Rogers) has endeavoured to ensure it, and also to give the latest possible information.

ESSAYS AND REVIEWS.

MR. W. H. LEVER ON PROFIT-SHARING.

EVERY contribution to the discussion of the difficult question of how to interest the rank and file of the labouring classes in their employment, how to persuade them of the fact that their interests and those of their employers lie in the same, and not in opposite, directions, and that both are served by the improved efficiency of labour, is welcome, even though the theories or suggestions of the writer be not altogether acceptable. Such a contribution has been made by Mr. W. H. Lever (the head of the well-known firm of soap-makers) to the January issue of the "Economic Review," in the form of an article entitled "Prosperity-Sharing *versus* Profit-Sharing in Relation to Workshop Management." The purpose of the article is to demonstrate the failure of profit-sharing, and the probable success of "prosperity-sharing," as a means whereby labour may be induced to take an interest in the success of the undertaking in which it may be engaged. We cannot say that Mr. Lever succeeds in persuading us of the truth of his proposition. His arguments may, however, be profitably considered.

First as to the alleged failure of profit-sharing. Mr. Lever says: "It is now over ten years since I ventured, in a public speech, to call in question the success of profit-sharing. The time that has elapsed since then has only confirmed the views I then held, both from the practical experience I have myself accumulated during the last twelve years, and also from the recorded experience of others, and especially from the Board of Trade report on Profit-Sharing, issued in 1894." He adds that he is well aware that books upon the subject, and newspapers, often refer to the success of profit-sharing both here and in America; but he thinks "most business men would prefer to be guided by the cold figures and statements contained in the Board of Trade report." Well, business men who are wise do not always accept unreservedly the pronouncements of the Board of Trade upon labour questions. They are too well aware of the undue faith in the infallibility of Trade Unionism displayed by the Labour Department. And never was care more necessary in regard to the acceptance of a Labour Department report than in the case of the one in question.

The following extracts from Mr. Lever's summary of that report will demonstrate this clearly enough. "Of the 48 firms paying full wages, Trade Unions existed for labour in the case of 27 firms, and labour was unorganized in the case of the remaining 21 firms. *No expressions of the views of labour on profit-sharing in the case of these latter 21 firms are recorded.*" [The italics are ours.] The "views" of the Trade Unions are given every prominence; those of the non-Unionists are not even recorded. Mr. Lever quotes some of the grounds of objection raised by Trade Unions to profit-sharing: "Conditions of scheme antagonistic to freedom of action of men, contrary to custom of trade, and *opposed to Trade Union principles.*" That, of course, settles the question. "The Union has never made any formal objection, but has always regarded the system as an excuse for getting the men to . . . turn out more work than under ordinary conditions." By ordinary conditions is meant Trade Union conditions, which are generally extraordinary. "Has a tendency to rob a man of his manly independence, *and to remove the scope and field of operations of Trade Unions.*" "Because a different system of working has been introduced, whereby two men have to turn out an amount of work equal to that which took three men to do." And so on.

Now, the conclusion drawn by Mr. Lever from these "opinions of Trade Unions, and from the fact that . . . no Trade Union has actively supported the system or agitated for its adoption," is that profit-sharing "does not appear to have commended itself to *labour*." This is a conclusion quite unwarranted by the grounds upon which it is based. Trade Unionism and labour are, happily for the country, not yet properly interchangeable terms. All that is proved by the Board of Trade report, which carefully refrains from quoting the opinions of non-Union labour, such as the employees of the South Metropolitan Gas Company—is that the officials of the Trade Unions, foreseeing that their occupation would be gone if a plan were successfully adopted whereby masters and men would be brought into relations of friendship and co-operation, have done all in their power to prevent profit-sharing ever having a chance of success, by misrepresenting its objects to the men, and by blinding employees to their true interests. Business men, who know anything of the subject, will prefer the actual experiences of employers whereon to found an estimate of the success or failure of profit-sharing, to the "cold figures and statements" in the Board of Trade report.

Mr. Lever gives, it is true, some very brief extracts from the reports of firms who have adopted the system, only, however, to sneer at the writers as pervervid enthusiasts who do not know their own business. Strange to say, the latest date he gives in these quotations is 1888. Why not mention such cases as the Bourne Cotton Mills, of Fall River (Mass.), who declare, after ten years' experience, that profit-sharing has been a striking success; or the Procter and Gamble Company, an American soap-making firm, who instituted profit-sharing in 1887, and have had no labour troubles since, while the men and Company alike are in better circumstances? Why say nothing of the South Metropolitan Gas Company with their eleven years' experience, and increased faith? Mr. Lever has, in point of fact, altogether failed to realize the true cause of the slow growth of profit-sharing in this country. While he, starting with a preconceived notion that profit-sharing is, as a system, economically unsound and "inherently bad," sees in its every failure and in its limited adoption only confirmation of this notion, others perceive that owing to the mischievous antagonism of Trade Unionism—having its roots in selfishness, and feeding upon ignorance—profit-sharing has had in but few cases a chance to be considered on its merits or comprehended as to its meaning by the working classes. All too many employers have, unfortunately for all concerned, failed in the energy or the courage needed to overcome the hostility of the Unions. To carry to success a scheme of profit-sharing requires unfailing energy, tact, and patience. But the result well repays the cost.

What, however, is this "prosperity-sharing" which Mr. Lever thinks so superior in its economics to, and so much more likely to achieve its objects than, profit-sharing? As outlined by its exponent, it seems an arrangement as little calculated to induce the drone to become an efficient worker as could be proposed. It is, in short, a proposal to set aside each year a certain share of the profits (Mr. Lever says "the share of profits *belonging* to labour," but gives no definition), not for the individual, but for the collective benefit of the employees; the sums so set aside to be spent in the building of clubs, recreation halls, and institutions, in providing summer holidays or winter entertainments, in supporting sick and burial societies, and so forth. An average amount to be spent in good and bad years of trade alike, and the expenditure to be at the discretion of the employer. Such a plan, therefore, makes it a matter of much less concern to the employee whether he works well or badly, than does that of profit-sharing; for he receives no direct personal (individual) reward, while the benefits he does receive do not obviously vary with the prosperity of the business. Moreover, as there is to be no power on the part of labour to demand any benefits, those granted would naturally be regarded, not as rewards earned, but as benevolences charitably bestowed. Yet Mr. Lever begins his article by remarking that he has had as an object that of excluding from consideration "all such acts of an employer towards employees as can only be correctly described as acts of benevolence, philanthropy, or charity."

We are much disappointed in Mr. Lever's article. The problem of securing conscientious, painstaking work in return for wages paid, is a difficult one, and, moreover, an increasingly serious one for this country. The antagonism of Trade Unionism to profit-sharing is a real difficulty in the path—though one that can be overcome by firm but patient and wise diplomacy—and any help in the direction of smoothing the path towards some rational co-operation between employers and employed, would be warmly welcomed. But we find no help in the article before us, the vital weakness of which is displayed in the sentence: "We have to be careful not to interfere with the functions and sphere of Trade Unions"—who live by the antagonism that exists where we desire to see co-operation.

WORKMEN'S INSURANCE IN GERMANY.

AT the meeting of the Chambers of Commerce at the Paris Exhibition last autumn, Mr. A. Domeier (formerly of the well-known firm of chemical brokers bearing that name) was requested to report to the London Chamber upon the exhibits relating to workmen's insurance against illness, accident, or infirmity, and to old-age pensions. We have now received a copy of Mr. Domeier's report, which contains much interesting information.

It is, however, not so much a digest of the exhibits at the Paris Exposition, as an account of the organizations established in Germany for providing insurances and pensions, and of the principles upon which those organizations are worked. Mr. Domeier explains his concentration upon the German system by remarking that "it would take months, perhaps years, of writing were I to report on what has been done . . . by all the various nations; and yet the conclusions at which I should arrive would be that no private arrangements, however perfect, nor trade society can replace what a wisely organized Government Department can and will do for the permanent benefit of all those who live by the work of their hands, and whose income is so small that it is difficult to make provision for a rainy day. Now, after careful study, I find that the only Government which has made arrangements which, if not quite perfect, yet in every respect very much approach perfection, is Germany."

We will not attempt to follow Mr. Domeier into all the details set forth in his account of these all but perfect arrangements made by the Fatherland for its children. They are undoubtedly admirably designed for their purpose; but it is decidedly open to question whether similarly detailed State regulated and managed systems of sickness and accident insurance would find favour among the working classes of this country. Englishmen have such a pronounced preference for managing their own affairs, and such a well-founded horror of having any more of those affairs managed by Departments of State than are already managed (or at times mismanaged) by them, that we do not think the German system, which works so successfully in its native land, will ever be adopted here.

It may interest those good persons who are so fond of gibing

at our own Workmen's Compensation Act because it has not been found to perfectly express the intentions of its authors, nor to contain provisions covering every possible case that may arise, to know that the first German law dealing with workmen's insurance (which was decreed in 1883), has since been amended or extended by nine further decrees, the earliest of which was enacted in 1884 and the latest in 1899. Those who are desirous of studying the German system in some detail would do well to become possessed of a copy of Mr. Domeier's able pamphlet.

ELECTRIC LIGHTING MEMORANDA.

The Maximum Demand System of Charging for Electricity—Its Application to Rochdale—The Better Way—How to make Municipal Electricity Supply a Solvent Business.

As was to have been expected, the beauties of the "maximum demand system" of charging for electricity are not always appreciated by consumers who find themselves entangled by this ingenious device for making electricity appear cheaper than it really is. An amusing example of this dissatisfaction occurs in the case of Rochdale, where the beginnings of the Corporation electric lighting trade were not very prosperous, on account of the high price of the unit. It is still a very green business, having been started only last year; but it did not take the local public long to discover that, whatever promises may have been made as to its economy, electricity at 6d. per unit is a pretty dear light for ordinary tradespeople to use. Rochdale is a flourishing manufacturing centre; but it is not a place where the inhabitants habitually drink champagne with their food, and to whom the luxury of having the electric light with it is an important consideration. Consequently, the first electricity bills were scrutinized in a spirit not identical, to say the least, with that in which the manager of a West-end restaurant regards the same item of current establishment expenses. It was perceived that the new light was going to cost at least three times as much as gas; and naturally there was an agitation for some substantial reduction. And equally naturally, the Corporation Committee could not see their way to carry on the undertaking at a bigger loss than they already contemplated. Accordingly they hit upon that plausible device, the "maximum demand system," and have just issued to the public a circular explaining this beautiful plan.

This is how the explanation runs: "The term maximum demand means the maximum number of lights used at any one time, and is quite independent of the number of lights installed. Thus a consumer may have 50 lights installed, but only use at the most 16 lights at any one time. The 16 lights are his 'maximum demand,' and he must use sufficient current to supply these for 100 hours in the quarter, for which he will be charged at the rate of 6d. per unit, and for any number of units in excess of these he will be charged at 4d. per unit only." This statement is as "clear as mud." It immediately evoked a small storm of indignant complaint from Rochdale owners and ratepayers, all interpreting the arrangement according to their lights, but all agreeing that the pretended concession is a delusion and a snare. One critic points out that if the man who is unfortunate enough to have 50 lights in his place when he only as a rule uses 16 lights—a somewhat strained hypothesis—should happen to want the whole number on the occasion of a fog, this becomes his maximum demand, and his claim to be supplied at the lower rate is thus demolished. Another complainant shows that the same result would follow as the punishment on the consumer's temerity in giving an evening party once in a quarter. One and all protest against the absurdity of such a system, which, as they say, consumers cannot understand, and when they do understand will certainly fight shy of.

Let Rochdale, exclaims a sensible writer to the local paper, have its electricity on the businesslike basis of 4d. per unit to the small consumer and 3d. per unit to the large user, discarding all fancy "systems" which are designed to catch the men of the "first hour." Why, it is the very convenience of electricity, the case with which it can be switched on and off, that constitutes one of its rare charms. Which is to be considered in running an electricity supply business—the convenience and satisfaction of the consumer, or the immediate financial necessities of the providers? If the latter, then doubtless a method of charging which catches the casual customer, and makes him pay somewhat in proportion to his cost to the undertaking, is one means of staving off bankruptcy. But if the intention is to render electric lighting really popular, it will not do to make fish of one possible customer and flesh of another. All these differential methods of charging are meant to level down prices all round eventually. It is better, therefore, when first impressions are being created, to treat all alike, on the lowest possible terms, even though the immediate consequence is a loss. Not to mention the big London Companies, which were content with a loss at first, now amply recovered, there are several shining examples of municipal electric lighting in different parts of the country which owe their prosperity to selling at 4d. per unit all round, and no questions asked. Municipalities especially can afford to stand at a loss for the first five or seven years of their electricity supply ventures, if they have had the wisdom to provide for meeting this temporary waste out of capital. That is the only proper method of financing a corporation electric lighting scheme.

We do not know how it is at Rochdale, and, indeed, the interest of the subject is for us of a general rather than a particular cast. If Rochdale has been deluded by the promises of the touting electrician into believing that electricity supply is going to be immediately remunerative, and eventually competent to return a huge annual surplus for the relief of the rates, the people are to be pitied. In any case, the sole prospect of making the Corporation undertaking solvent is to procure as large a business as possible; and this is only to be done by selling a good and a cheap article upon terms that the people can understand. All differential and fancy ways of charging for a commodity, apart from the well-understood trade principle of allowing reasonable discounts for large purchases or for prompt payment, are reactionary. They savour of the period when shopkeepers would only sell cheap sugar to customers for dear tea; when only purchases of a certain minimum value could be sent home; and when bankers scorned to honour small cheques. All this fuss and frippery has passed out of date. It was based upon solid reason, of course; for everyone consented to it while it lasted, and understood why the obsequious shopwalker could stand bareheaded beside my lady's barouche to take the usual commands for the big house, while he hardly thought it necessary to be civil to the workgirl who only wanted a little morsel of provision to be paid for on the spot and taken away by the purchaser. Times have changed; and electricians of all men should change with them.

THE PICTURESQUE IN GAS-WORKS CONSTRUCTION.

It is a curious coincidence that the same week that witnesses the completion of our illustrated description of the new Zürich Gas-Works should have also seen an unprecedented attempt on the part of a young and enterprising London newspaper to suggest the beautifying of a town gas-works. It is something so novel and in itself praiseworthy for those who undertake the formation of public opinion by means of the Press to spare a thought for the gas-works, one of the helots of the modern town, that we quite gratefully reproduce our contemporary's ingenious idea.

The first thought striking one on seeing these sketches, p. 265, is to compare them, first, with what one remembers of an old-fashioned gas-works such as the artist must have had in remembrance, and secondly, with the pictures that have been published of such highly developed establishments of the same kind as have recently been constructed at Amsterdam, at Vienna, and at Zurich. We are afraid that we cannot include in the same category any British gas-works. It would, of course, be very easy for a severe technician to make fun of the "Daily Express" design, which, as the artist himself confesses, distinctly recalls the notion of a Cathedral or a Palace. To this extent, therefore, his idea stands self-condemned; for it is one of the elementary rules of architecture that a building should proclaim its purpose and use. It cannot be right, and consequently must be inartistic, for a gas-works to resemble a collection of temples. This initial objection being taken, however, we are free to admit that there is a certain value in the "Daily Express" criticism of the crass utilitarianism of the style of gas-works design from which it takes its datum. There are two aspects in which a town gas-works may be regarded—one being that of a factory pure and simple, wherein bulky and dirty materials have to be manipulated at the lowest possible cost for capital outlay and working expenses; and the other that of an element in the necessary equipment of a city. There are many other elements of the same nature which go to make a modern town an eligible place of business and residence. Railway stations for passengers and goods, docks, wharves for coal and timber, markets, water-works, all stand on the same footing. In some towns, factories for textile and other manufactures, iron-works, chemical works, even collieries, are necessarily salient features of the panorama which spreads itself round the town hall.

It is hardly necessary to observe that, whether for good or for evil, these appurtenances of civilization have usually in England been embodied in a strictly working dress, without the slightest regard for the picturesque. The case of town gas-works is therefore not exceptional. On the other hand, it is possible to argue that, for some localities at any rate, the quality of picturesqueness ought not to be ignored, even in connection with factories and public service works. Most people would agree that a railway or a gas-works, forming part of the belongings of a naturally handsome city, should be adjusted to the amenities of the locality. This, it appears to us, is the real meaning of the suggestion we now reproduce; and so far it is deserving of a considerable meed of respect. It is a way of looking at the matter to which British technicians have not hitherto always paid sufficient heed. In the details of mechanical construction, English practice has been distinguished by a regard for finish and workmanlike style which compares favourably with anything of the kind in the world. The plating, riveting, and framing of our gasholders, for example, are of acknowledged excellence; and the same may be said of English-made locomotives, railway rolling-stock, and other staple products of mechanical engineering. On what may be called the architectural side of our industrial constructions, we have undoubtedly betrayed the limitations of our æsthetic sensibility. Herein of late years, in regard to the design and building of town

gas-works no less than of railway stations, we have fallen behind the foreigner.

Continental gas engineers have had the advantage of being able to rely upon public taste to justify them in spending money to make their constructions pleasant to look at as a whole, as well as technically efficient. The fashion which has persisted on the Continent, of enclosing gasholders in permanent buildings of masonry or brickwork, has made the ordinary European gas-works susceptible of good architectural treatment. This alone constitutes a notable distinction between English and Continental gas-works design. The gasholders occupy the foremost place in the "Daily Express" sketch as they naturally form a striking feature of any panoramic view of a town. If therefore they can be corrected from being an eyesore, and made an agreeable monument, the rest is easy. Retort-houses, water-towers, and all the other buildings of a gas-works lend themselves readily enough to architectural treatment. Thus the problem is solved. How long it will be before the designers of English gas-works are supported by public opinion in emulating the artistic triumphs of their Continental brethren is a long question, the answer to which does not depend upon themselves.

THE FITTING AND USE OF GAS WATER-HEATERS FOR BATHS.

The recent occurrence of several regrettable fatalities traceable to the improper fitting or injudicious use of gas water-heaters for domestic baths has naturally provoked some comment on the common practices in this regard of gas-fitters and householders. It was to have been expected that the Medical Press, which usually pounces upon such topics and gives an alarmist turn to the lessons derivable from the occurrences, would not have let slip so obvious an occasion for moralizing on the possibility of people dying without medical assistance; but the opportunity has been allowed to pass. The subject has, however, been very properly noticed by the "Builder" and the "Ironmonger;" and it is right that at least one aspect of it should be discussed here. The "Builder" falls back upon the not very hopeful recommendation that geysers should, wherever practicable, be fitted outside, not inside bath rooms; and, failing this, advises the provision of a flue for carrying away the combustion products and ventilating the room, "without regard to any statement from the gas-fitter or the vendor of the geyser concerning the needlessness of such flue." It is further remarked that if the bather would take the precaution to turn off the gas before entering the bath, fatal accidents arising from the use of gas-geysers would be less frequent. Upon this counsel we have to remark that the last observation is uncalled for. Fatal accidents from the use of gas-geysers, using the term in its generic sense, are by no means frequent. On the contrary, they are very rare, having regard to the number of such appliances in use. Deaths in baths, from general causes, are far more common; and the mortality returns would not be noticeably affected if every gas-geyser were put out of use to-morrow.

There is not much hope of the general fitting of bath water-heaters outside bath rooms. The apparatus must be under the command of the bather, which means that he must have it with him when he is undressed. The other points, of ventilation and turning off the gas before entering the bath, are more elaborated by the "Ironmonger," which treats the whole subject in a masterly way. This trade journal has naturally been plied with letters on the recent fatalities, from some of which has not been absent the desire to turn to a selfish trade advantage occurrences which ought to be differently regarded. We are not going to lend our own pages to any such improper use, whether directly or indirectly; but intend in the first place to assist the "Ironmonger" in keeping the discussion of the subject upon a common-sense basis, and out of the panic-mongering half-penny newspapers, and, secondly, to touch upon its statutory aspect.

Absolute safety in using a bath water-heater is not a question of the employment of the luminous or the atmospheric flame. The former is likely to be less offensive and (so far as the risk of danger from the products of imperfect combustion goes) safer than the latter; simply because it makes soot, and smells vilely if the flame is not completely burnt out without touching any solid body. The satisfaction of the prime condition of perfect and therefore non-poisonous combustion is thus guaranteed by the two senses of sight and smell, acting simultaneously. The atmospheric flame, on the other hand, is not only not allowed to burn itself out completely before being permitted to touch a solid body, but it is chosen expressly in order that no such nuisance as the deposition of soot may occur if it does touch anything. This is true not only of water-heaters, but also of gas cooking-stoves and gas-fires. Now, what the careless manufacturer, fitter, and user of these appliances which have the atmospheric flame do not always know, is that such a flame should no more be allowed to touch a solid body than the luminous flame itself. If it does, the flame will go partially out. The unburnt gases will not ignite again; but they will stink with the only too-familiar stench from which every person in full possession of his senses revolts. That stench unquestionably covers the presence of the deadly poison, carbonic oxide. It is not an easy matter to get rid of this evil-smelling, dangerous product of a smothered atmospheric gas-flame when once evolved. It will often pervade a house, from a down-stairs kitchen where cooking by gas is going on. Flues may be attached to the apparatus; but it does not follow that they will act properly. Yet, notwithstanding the difficulty and the uncertainty of their action—which should be corrected so far as possible by providing adequate ventilation of the apartment containing the apparatus—no flueless gas appliance in which a large atmospheric burner can come into contact with a solid body ought to be permitted to be used in an occupied room. Nobody could live in a closed room warmed by a gas-fire of the usual construction, with a down-draught from the chimney. Deaths have been so caused. It is a pity that, owing apparently to a defective sense of smell, which is not uncommon nowadays, the stench of a smothered atmospheric gas-flame is not found more objectionable by householders, or is not more noticed in the kitchen or the bath room where it most often occurs. Those people who do object to it, do so very strongly indeed; and others would be more like them if they suspected the force of the warning given by this acrid odour.

Therefore, we cannot wholly agree with the "Ironmonger" in holding that it is immaterial whether the user of a gas appliance is in possession of something which yields in burning either carbon monoxide or carbon dioxide. The broad difference between the two classes of appliances is that the former imperatively calls for adequate and efficient flueing for itself; while the latter is quite safe and inoffensive with only the common ventilation of the apartment in which it stands. Of course, the more gas there is burnt in any room, albeit quite safely, the more ventilation is required. Just as when a score of persons are crammed into a room intended for four or five inmates, it is expedient to open the doors and windows. The analogy is complete. Only the mischief is that the atmospheric effects of the use of a large gas appliance are not so obvious as with a crowded assembly; and what the eye does not see, the mind is not always sufficiently acute to perceive.

We must not be misunderstood as depreciating the atmospheric gas-burner in itself. Properly treated, the atmospheric flame is as innocuous as the luminous flame, and the products of its complete combustion are the same—carbonic acid, water, and an inappreciable quantity of sulphurous acid gas. Under identical conditions, both methods of burning coal gas in a close apartment tend to exhaust the air of oxygen and increase its content of carbonic acid, as the most notable effects of the combustion. The mischief is that sometimes the atmospheric flame is intended, through ignorance, to be used in a way that would not be possible with the luminous flame—that is, half smothered. Makers, fitters, and users abuse its material cleanliness. They do not know that it yields its best heating duty when the substance to be heated is just touched by the outside skin of the completely burnt flame. It is the same with the luminous flame; but the practical difficulty in the use of the latter for heating lies in preserving this condition for different pressures of gas and rates of consumption. If the luminous flame gets too long and touches anything, it smokes and smells. If the atmospheric flame is similarly altered in length and gets smothered, it smells; but it does not smoke. It is simpler and cheaper to take the risk of the latter method of burning gas for heating purposes. But it is well that manufacturers of stoves and water-heaters who elect to use the atmospheric flame should know the rights of the matter, and strive after such an adjustment of the flame as will keep it as nearly as may be in its proper place with relation to solid bodies. Smothering being inevitable, its products must be safely conveyed away without getting into the atmosphere of the room. Of course, the method of burning does not affect the calorific value of the fuel.

This being clearly understood, we can join hands with the "Ironmonger" as regards the fitting and use of gas-heated baths in general. This is more than a mere question of the appliance itself. Both the character of the bath room, and the use of the bath, require careful consideration. The room should be reasonably well ventilated; and neither door nor window should fit too closely. If the heater can be fixed outside the room altogether, as when the room is very small, so much the better. In any case, the gas-burner must never be so disposed that the products of combustion, chilled by the running water, can fall into the bath itself. It is better to place the heater at the farthest distance from the bath than to fix it, for the sake of the bather's convenience, where he can reach it while in the bath. It should be remembered, further, that the act of taking a hot, or even a cold bath, is apt to induce faintness or syncope in the case of some persons. A little reasonable solicitude on this account is thus to be commended alike to bathers and to those responsible for the proceedings of the household. It is, as the "Ironmonger" avers, a grave error to construct bath rooms with almost burglar-proof doors, or to leave them without a bell or some means of attracting attention. A small stained or ground glass panel near the door handle and bolt, to be smashed in case of emergency, is a good precaution to take. A certain amount of surveillance over the occupancy of the bath room, so as to discover when things are going wrong, is not too much to expect of a well-ordered establishment. This care is especially necessary in regard to children, invalids, and the aged. Now that fixed baths are so common in houses, familiarity with the luxury has bred contempt of its risks.

Lastly, there is the question of responsibility for the proper fitting and arrangement of a gas-heated bath. Plumbers and gas-fitters are certainly justified in refusing to execute orders which their technical knowledge warns them to be incompatible with safety. But the "Ironmonger" goes too far in laying it down that

no geyser or water-heater of any description should ever be fitted in a bath-room to which circumstances deny a special flue. If the room in question is of reasonably large size, with a door, and a window opening into the outer air, a luminous-flame water-heater can be quite safely put into it, without any special flue of its own, provided that the apparatus does not stand directly over the bath itself. A water-heater with atmospheric flame must have a special flue either leading into a chimney, or carried up outside the house with proper precautions against any down-draught. The responsibility for carrying this arrangement out properly rests upon the person who undertakes the work.

In France, or at any rate in Paris, a paternal Government has ordered a regular service of house inspection, with the object of assuring the sufficiency and integrity of all stove flues, presumably inclusive of those of gas-heating appliances. This is a development of the well-known solicitude of Continental city governments for the efficiency of the chimney-sweeping. It is stated that the idea of stove-pipe inspection was suggested by the frequency of cases of asphyxiation from the "Choubersky" and other patterns of slow-burning coke and charcoal stoves so largely used in the French capital, often with very primitive chimney provision. It is not at all likely that administrative interference of this kind will commend itself to British municipalities as coming within the range of their duty to the public; but as regards gas-fittings, it is becoming fashionable for both gas companies and municipal gas departments to take statutory powers to prescribe and inspect consumers' fittings in new buildings. How far this proceeding extends the responsibility of the suppliers of gas may be a disputed point, which it is desirable should be cleared up. There is actually in course of promotion a Bill in Parliament (the Shipley Gas Bill), by which a District Council seeks power to make bye-laws with the object of "preventing misuse of gas and for preventing accidents" in connection with the supply. The idea is to relieve the Council of the obligation to supply unless the bye-laws are obeyed. It looks very much like undertaking a serious additional responsibility.

AMERICAN ENGINEERING COMPETITION.

[First Article.]

The question of the probable extent and effect of the competition of American iron and steel manufacturers with their English rivals continues, and is likely to continue, to occupy no small place in the thoughts of the intelligent and informed among us—more especially of those engaged in the industries directly affected, and in those to which the prices of iron, steel, and coal are of vital importance. As falling within the last of these categories, gas managers are particularly interested in the subject; but they are further concerned in its discussion by reason of the fact that a consideration of the conditions that favour American manufacturers in the struggle for supremacy is likely to be of no small profit to all concerned in the management of large industrial undertakings. There are, in fact, three aspects of the question, all of much importance and worthy of attention—namely, the economic effects of American competition and the probable duration of those effects; the elements of the success attending the management of large business concerns in the States; and the difference between the spirit animating the working-classes on either side of the Atlantic. Since last the subject was dealt with in these columns, much additional evidence has accumulated; and several more contributions of weight have been made to the discussion. It is, therefore, proposed to deal with the fresh matter bearing on the three aspects to which we have referred, in the order in which they have been named.

The basis of previous articles, it will be remembered, was a series of contributions to "The Times," by a Special Correspondent, in which he embodied observations he had made in the course of an extended tour throughout the engineering works of the States, and the conclusions he had drawn from those observations. A further three communications from the same pen have now appeared (in "The Times" for Dec. 26 and 29, and Jan. 8); and they contain so much of both interest and value, that it is to be hoped they will receive the attention they deserve. Let us repeat here that the nation is indebted to the enterprise of our contemporary for these able papers upon a subject of great and pressing importance; and the whole series should be brought directly before the public by publication in collected form.

In his earlier letters (which began to appear in the spring of last year), the correspondent described the enormous development that has been, and is, going on of the productive capacity of the iron, steel, and machinery works in the States, while economies, improvements, and other causes were bringing down the cost of production and transit to a low level; and he warned this country that the owners of these works had the intention of putting their surplus output on the markets of the world at very low prices, so soon as the productive capacity should materially exceed the requirements of their home markets. Before the end of the year, the competition so predicted began to make itself very decidedly felt by English producers—to the no small advantage of the consumers both of metal goods and of coal. The writer in "The Times" brings forward as proof of this fact extracts from the reports furnished to the engineering journals by their local correspondents. This evidence may be supplemented by statements made by certain manufacturers in Scotland in their notes upon the course of business last year, which appeared in the "Glasgow Herald" of Dec. 27, and have already been referred to in the "Journal." The following are a few extracts therefrom.

The Steel Company of Scotland state that "the year 1900, which opened with large expectations, and with a great volume of business doing, proved, notwithstanding, a year of exceptional anxiety and disappointment. . . . The pressure continued during the first six or eight months of the year, after which a marked change took place, due to a large extent to competition from America and Germany . . . so that the year closes in something like gloom and doubt. . . . There has been a falling off in foreign orders; America having secured a considerable share of orders both for Australia and Japan. They have also secured the entire Canadian trade." David Colville and Sons remark that "unless workmen and coalowners in this country realize the position due to foreign competition, and consent to a re-adjustment of costs necessary to meet the same, the outlook for 1901 is unsatisfactory, and must result in a number of the works in the district closing until this is remedied. Neither the harbour authorities nor the railway companies in this country have equipped themselves in the manner Americans have done for handling the ore traffic cheaply. The clever labour-saving appliances which Americans have adopted for the ore-carrying traffic have not yet even been attempted here." In the malleable iron trade, the makers report that "a general depression has taken place both in the volume of business and prices. The fall in prices has been largely caused by the competition from America and Continental countries; and at the present moment trade, as a whole, was never in a worse state, so far as Coatbridge is concerned." And again: "The general outcry in the locality of Coatbridge among the iron masters, is the enormous price that has to be paid for coal, and the fact that American manufacturers have been delivering tubes at considerably lower rates than British makers."

Then it is stated: "American competition every year grows keener in harvesting machinery . . . and, just as large British makers have in past years absorbed all the small local makers' trade, the question with many now is: Are the large millionaire firms of America to absorb the trade of the large British makers? Everything points in this direction. The American firms have everything in their favour—complete protection in their own country, and free labour without any restriction as to the men's output; while the British manufacturer is harassed and handicapped on every side by the restrictions of Trade Unions." In the glass trade, it is said, the Americans have reversed the order of things that existed a few years since. They now export glass goods to England on a considerable scale, whereas formerly they imported large quantities themselves from Glasgow. "Some of the American firms are said to have carried out the Continental plan of blowing glass in moulds very successfully, and state that the workmen assist their employers in introducing any new mode of working, and not, as in this country, try all they can to prevent them. . . . The true American workman is said to be a temperate man; and manufacturers have not to complain of the intemperance of their workmen as British manufacturers have to do." A similar story is told in regard to the earthenware trade; the high price of coal and materials on this side having given the American competitor a chance to get his foot in.

The only exception to this striking consensus of opinion is found in the attitude of contempt taken up by the locomotive-building trade towards their American rivals; and probably so long as the English railway companies' engineers insist upon the expensive fad of each having his own special design of locomotive, the English maker will have little difficulty in retaining the market. This forms the one contrast to the general agreement as to the damage being done to trade by the competition of America, fostered by the exorbitant prices of coal and iron in this country.

It may, of course, be contended that it is only the great inflation of prices here that has rendered it possible for American makers to capture so much of our trade, and that a return of coal and iron to average prices is all that is necessary to its recovery. Were this the full measure of the present and future influence of American competition upon our home markets, that competition would have been a great and unmitigated blessing, for which none are more devoutly thankful than the gas managers in this country. To aver that the industrial expansion of the United States will have a more wide-reaching effect upon our commercial future is to enter the domain of prophecy, and time can alone determine the value of the assertion. But we feel confident that, be the permanent effect what it may, no short time must elapse before the trade of this country can possibly adjust itself to the altered circumstances created by the advent of this strenuous and rapidly growing competitor—resourceful and with unlimited resources—in the markets of the world.

Those most inclined to under-rate the prospects of American trade and its effect upon this country, are very fond of appealing to history. Our supremacy has been said to be in peril, they remark, from time immemorial; but we have always come out "top boy" somehow. Why should not we do the same in future? The only reply—and a sufficient one in our opinion to dispose of the appeal to history as a conclusive argument—is to ask whether at any time in the past the circumstances were even approximately the same as at present. A shopkeeper whose business had an unbroken record of success for a couple of centuries prior to the advent of the modern co-operative store, would have

found history nothing but a delusion and a snare had he relied upon that alone, and neglected to readjust his prices and his business methods. Indeed, many shopkeepers have come to utter grief through failure to realize the need of such adjustment.

Just as those tradespeople have had to face circumstances unknown in the past history of the retail business, so have our manufacturers to face an unprecedented situation. It must not be forgotten that the history of industry having its foundations upon steam-generated mechanical power does not extend over more than a bare century—as "The Times" special correspondent strikingly puts it, "steam has placed Napoleon nearer to Cæsar than to the present day;" that it is only in the last few years of the century that this country has met with any considerable competition in the modern fields of industry; and, finally, that never have we before had to face the rivalry of a nation endowed with sagacity and intellect equal to our own, and possessing vaster natural resources and capital for their development.

Thanks to our own enormous and conveniently situated stores of mineral wealth, and to the fact that we were quick to seize and profit by our opportunities as soon as we perceived them, and before other countries perceived, or displayed the energy to lay hold upon, theirs, we have never before had to meet competition on level terms. To again quote from "The Times" correspondent: "We were first in the field; we had a long start in the race. . . . America, our great rival, was engaged in peopling her vast undeveloped territory; Germany, as we now know her, did not exist; and the other countries seemed to concede to us the *rôle* we had allotted to ourselves of 'The Workshop of the World.'" Now, however, "England is no longer the sole heir of her great forefathers; our brethren abroad have claimed their share of the inheritance."

American competition, then, has "arrived," and has had immediate result in the absolute collapse of the "boom" in the engineering trades, in a more sudden fashion, and at a much earlier date, than it would have been achieved by the operation of the inevitable trade reaction in this country. The fear of it must have a moderating influence upon prices in any subsequent industrial revival here; and it is possible that it may produce in the near future severe trade depression, the duration of which will largely depend upon the rapidity and success with which English manufacturers adjust themselves to the changed circumstances. To enable them to do so, they must find and train more brains for use in the organization of their undertakings, and the workpeople must increase their productiveness. On these points, we shall have something to say in a further article.

THE GAS AND WATER STOCK MARKET.

Business is not commonly believed to yield to sentiment; but there is no more loyal or sympathetic body of men than the members of the Stock Exchange, and it is no exaggeration to say that the sincere grief felt by the whole nation at the loss of their beloved Queen was shared to the full by them, and for awhile overlay the thought of dealing. On Wednesday morning the Committee met promptly, and ordered the House to be closed at once. For the rest of the week, before and after that day, business was naturally quiet; but it was plainly gaining in activity from day to day towards the close. The general tendency, too, was favourable and firm, though not without some exceptions, and the gilt-edged division were in very good case—Consols leading the advance with a rise of ¾. In the Money Market, the position was at first inclined to be easier; but the relaxation was soon checked; and rates at the close were quite firm. Business in the Gas Market was very quiet indeed, and was for the most part quite devoid of interest. Changes in quotations were few and irregular. Gaslights were the only issues that were at all noticeable, where the ordinary moved with uncertainty—first falling a point, and then recovering it again later on; so that the opening and closing transactions were marked at just the same figure. Perhaps the tendency will be more settled when the half-yearly accounts come out this week, and the position of affairs is more clearly ascertained. At present, it only appears that, in order to pay the £4 8s. rate of dividend, an amount equal to £1 per cent. has to be taken out of the balance brought forward from last half year. The secured issues were rather more active and steady. South Metropolitan changed hands two or three times at good middle figures, without giving any sign of variation. Nothing at all was marked in Commercials. Among the Suburban and Provincial group, there were more changes. Newcastle had another good rise—4 this time; and Liverpool had a small advance of ½. But Southampton was lower, and its debenture was put down from the altogether too high price at which it had been left figuring. There was little business done in the Continental group, and the only feature was some weakness in Union. In none of the remoter undertakings was there anything calling for notice. Business in the Water Companies was almost equally devoid of interest; and the only move was a slight fall in East London debenture.

The daily operations were too restricted in volume and too commonplace in character to call for detailed notice. Gaslight ordinary moved down 1 on Monday, and recovered it on Friday. Both issues of Continental Union fell 2 on Monday. Southampton dropped 2 on Friday, and ditto debenture 10 on Thursday. On Saturday, East London Water 3 per cent. debenture fell 1.

PERSONAL.

Mr. W. V. Watson, the Manager of the Felixstowe Gas-Works, has resigned his position; and the Directors of the Company have appointed Mr. Frank Paternoster, who has been for some years with the Ipswich Gaslight Company, as his successor.

The appointment of Mr. E. W. Wright as Manager of the Driffield District Council Gas-Works has been confirmed. Mr. Wright will also undertake the duties of Engineer; the Council having determined not to retain the services of a Consulting Engineer after the expiration of the current financial year.

Mr. G. Mead Robins, Secretary and Engineer of the Sutton (Surrey) Gas Company, writes, in reference to the paragraph on the Reigate appointment which appeared last week, that the office of Engineer and Manager is not vacant, and is still held by himself; Mr. Price having taken up duties at the Reigate works as Works Manager.

In response to the invitation which appeared in the "Journal" a few weeks ago, 31 applications were received for the position of Gas Engineer and Manager to the Chorley Corporation, rendered vacant by the appointment of Mr. John M'Cubbin as Resident Engineer to the Hong Kong and China Gas Company. A selection of four candidates was made; and eventually Mr. J. W. Allin, Assistant Engineer at the St. Helens Gas-Works, was unanimously chosen. We learn that Mr. M'Cubbin will leave England early next month to take up his new duties.

OBITUARY.

Stevenson Macadam.

We regret to record the death, last Thursday morning, at his residence, Brighton House, Portobello, of Dr. Stevenson Macadam, Lecturer on Chemistry at the Surgeons' Hall, Edinburgh, in connection with the Royal College of Physicians and Surgeons. Dr. Macadam sustained a slight injury while fishing last September (he was a keen angler, and President of the Edinburgh Angling Club); but nothing serious was feared till some time afterwards, when blood poisoning supervened, to which he succumbed. Deceased was one of a family of four sons, three of whom adopted chemistry as their profession. One of them—John—was assistant to Dr. George Wilson, in Edinburgh; and on his leaving Scotland, in 1847, to take the appointment of first Professor of Chemistry in the University of Melbourne, Stevenson succeeded him. He remained in this position until 1855, when he started classes especially for the pharmaceutical students. When Dr. Wilson became Professor of Technology in the University, Dr. Macadam was made Lecturer on Chemistry in the School of Medicine. He continued teaching until the close of the last summer session, at which period he had completed 50 years as a lecturer, 45 of which had been as an independent teacher. Early in life he graduated as Doctor of Philosophy at the University of Giessen, and in 1855 was elected a Fellow of the Royal Society of Edinburgh. He joined the Royal Scottish Society of Arts in 1854, and served in various offices until 1862, when he was made President, which office he held until the close of 1864. He was a Fellow of the Chemical Society, and an original member of the Institute of Chemistry and of the Society of Chemical Industry. He was the author of many papers on scientific subjects, mostly dealing with technical matters, such as water supply, drainage, and the application of chemistry to the arts and manufactures. Dr. Macadam was known personally or by repute to many of our readers, more especially to those in Scotland, as he displayed a keen interest in gas matters, his knowledge of which was extensive and profound. As long ago as 1873, he delivered a lecture to the British Association of Gas Managers, at their meeting in Edinburgh, on "The Physico-Chemical Properties of Gas;" and he was then elected an honorary member. He was afterwards present at the meetings from time to time, and took part in the discussions. To go back no further than the past decade, he was at Carlisle in 1891, at Belfast in 1893 and again in 1898, at Edinburgh in 1895, and in London the following year, when he spoke on the papers on "Photometry" by Messrs. Dibdin and Sugg. He was also an honorary member of the North British Association of Gas Managers, and is the third honorary member of that body who has recently died. He at one time took great interest in the affairs of the Association; but latterly his business engagements occupied so much of his time that he was unable to attend the meetings. The last occasion on which he was present was at Dundee, in 1893, when he criticized the Peebles oil-gas process—not altogether in an appreciative tone—which had just before then been brought out. He was a scientist of deep research, and was an authority in all matters relating to physics, and carried on a large consulting practice. In public life, he was known as one of the most learned expert witnesses of his day. There was scarcely a big litigation for many years, involving chemical inquiry, in which he was not a leading witness; and he was, on at least one occasion—a serious explosion in flour-mills at Tradeston, Glasgow—appointed by the Court of Session to report upon the scientific aspects of the disaster. Deceased, who was 72 years of age, leaves a widow, two sons, and two daughters; one of the sons being Professor W. Ivison Macadam, of Edinburgh, who is not only an authority on chemical matters, but, like his father, has a leaning towards subjects relating to gas manufacture. His name and works are too well known to call for reference.

IN THESE TWO SKETCHES THE "DAILY EXPRESS" OFFERS SUGGESTIONS FOR BEAUTIFYING LONDON.

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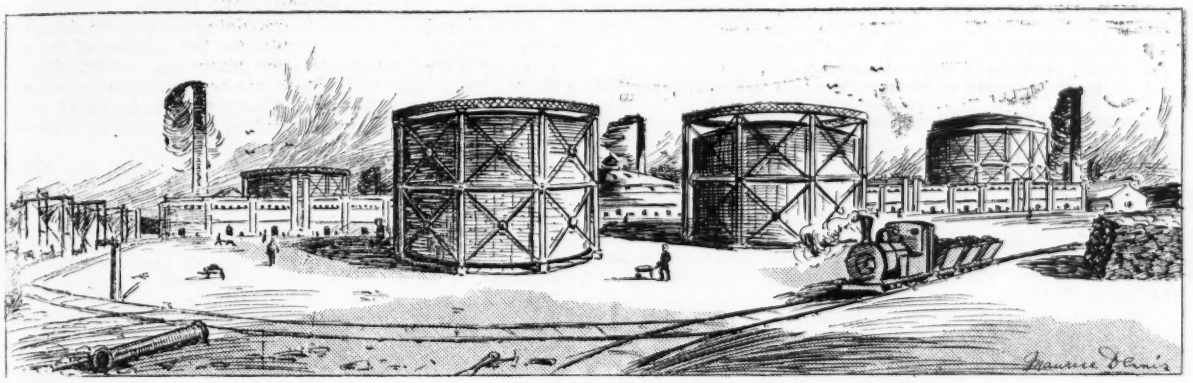
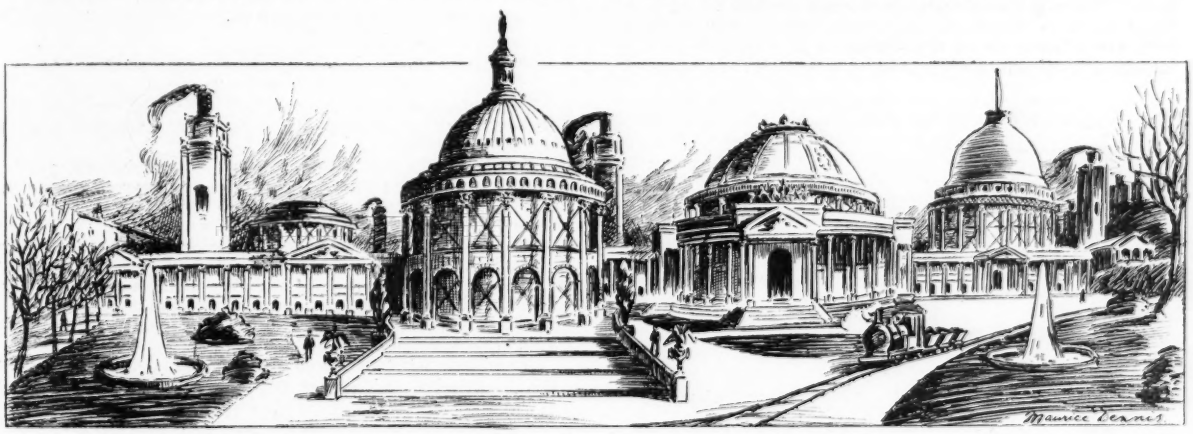
——*See Article on Page 261.*——



Compare this Picture with its Companion below, and you will see how the Ugly Gas-Works, so common in our Great Cities, might be made into Places of Architectural Beauty.—*Daily Express.*



This is not meant for a Cathedral or a Palace. It represents the Gas-Works of the Future, when the County Council or Corporation insists that such Buildings shall have Architectural Merit.—*Daily Express.*

THE NEW GAS-WORKS AT SCHLIEREN, ZURICH.

(*Concluded from p.* 204.)

G.—The Leading Main from Schlieren to Zurich; and the Feeding Mains in the Town.

The leading main starts from the works, and follows the Rue de l'Industrie and the Rue de Hardturm. These roads join the Communes of Schlieren and Altstetten with Zurich, and serve the district included between the River Limmat and the North-Eastern line. The gas-main is laid under the future pavement of the road; and the space required by a second pipe has been allowed for. The principal main leaves the works at a point where there is a bend of 90°. Its diameter is 1000 mm. (39·37 inches). A branch for a 600 mm. (23·62 inches) pipe to follow the Badenerstrasse has been arranged for. At the point where this is taken off, the diameter of the leading main is 800 mm. (31·50 inches), up to the Hartstrasse, where it connects to the existing 700 mm. (27·56 inch) pipe. The proposal to lay the second main in the Rue de l'Industrie has been given up, owing to experiments made since the starting of the new works. This reserve pipe will probably be put down in the Badenerstrasse. It will be connected to the town boundary by the present main of 600 mm. (23·62 inches).

The sizes of the leading main from Schlieren to Zurich have been based upon the following considerations: Number of inhabitants to be supplied in the area, 150,000. Expected gas consumption, 80 cubic metres (2825 cubic feet) per head per year, which gives a total of 12,000,000 cubic metres (about 423,800,000 cubic feet). [The annual gas consumption per head of the population of Zurich has, in fact, up to the present been lower than the consumption in other towns, amounting last year to only 55 cubic metres (1942 cubic feet).] According to experience, the greatest daily consumption is 0·5 per cent. of the annual output. This will therefore be in our case 60,000 cubic metres (2,118,000 cubic feet). The maximum hourly output is about 15 per cent. of the greatest daily supply—*i.e.*, 9000 cubic metres (317,800 cubic feet). A pipe 1000 mm. (39·37 inches) in diameter can supply 9000 cubic metres of gas, with a loss of pressure of 7 mm. (0·276 inch) per kilometre (1093·6 yards). The speed of the gas in this case is 3·25 metres (10·66 feet). The same calculation made for a daily output of 100,000 cubic metres (3,530,000 cubic feet) gives—

Maximum hourly output, 15,000 cubic metres (529,700 cubic feet).
Loss of pressure, 20 mm. (0·787 inch) per kilometre.
Speed, 5·05 metres (16·57 feet) per second.

This speed is, as it stands, a little too much, and is one of the reasons which led to the laying of a second feeding main being adopted. The 1000 mm. main has a length of 3121 metres (3413 yards); and the difference of level in this length (from the gas-works to Förrlibuck) is about 5 metres (16·4 feet). As a result, there are the following losses of pressure:—

For 9000 cubic metres output, 3·121 × 7 − 4 = 17·847 mm.
,, 12,000 ,, ,, ,, 3·121 × 12·2 − 4 = 33·9 ,,
,, 15,000 ,, ,, ,, 3·121 × 15 − 4 = 42·8 ,,

The gasholders give, when full, a maximum pressure of 224 mm. (8·814 inches). There is also a pressure above 150 mm. (5·905 inches) at the moment when the gas begins to leave the third lift of the gasholder. It will be seen, then, that at the end of the 1000 mm. pipe—that is, up to the point where the 800 mm. and 600 mm. branch off—there is a pressure of 150 − 33·9 = 116·1 mm. (4·57 inches), which is quite enough for an output of 12,000 cubic metres. From this point, the pressure conditions are still better; and pressures above 100 mm. (3·93 inches) have been noted in Hardstrasse, and above 120 mm. (4·72 inches) in Badenerstrasse.

The following particulars as to the laying of the mains may be of interest. The work of trenching and laying was given to two contractors at a fixed price. The laying had to be stopped for five months, owing to difficulties with the Commune, and to details relating to obtaining right-of-way through the necessary land. The total length of the main in socket pipes is—

Lot I.—(1000 mm. pipes) . . . . . 3121 metres.
Lot II.—(800 mm. pipes) . . . . . 1721 ,,

4841 metres (5294 yards).

This was carried out in 140 working days, which gives an average progress of 34·5 metres (37·73 yards.). One lot gave—

68 metres (74·37 yards) as the maximum progress.
4 metres (4·37 yards) as the minimum progress.

Seven syphons have been laid in Lot I., and four in Lot II. The

greatest distance between two syphons is 593 metres (648·52 yards), and the least 174 metres (190·29 yards).

Maximum slope of the main	. . . . .	8·6 per 1000.
Minimum ,, ,,	. . . . .	3·3 ,,
Average ,, ,,	. . . . .	4·5 ,,

The soil was generally bad. Further, at certain points, and in the gravel, large inrushes of water had to be fought, which necessitated costly installations of pumps, without which the laying would have been impossible. The main rests for a length of—

490 metres (535·88 yards) on gravel and sand.
1640 metres (1793·55 yards) on clay (in places with frames of strong joists 60 mm., or 2·36 inches thick).
2711 metres (2964·84 yards) on cross-beams and strong piles.

4841 metres (5294·27 yards) total length as above.

There were used in all 2710 piles and 1355 cross-beams. The total length of round wood employed, the diameter of which varied from 18 to 30 cm. (7·08 to 11·81 inches), was 5900 metres (6452 yards). In addition, the main had to cross twelve ditches and streams, and eleven streets and roadways—sometimes above and sometimes below. These bridges and tunnels were carried out by the hands of others.

The total weight of the 1000 mm. main is	. . .	1,373,140 kilos.
,, ,, ,, 900 mm. ,,	. . .	602,000 ,,
The weight of special pieces is	. . . . .	30,260 ,,
Total weight	. . . . .	2,005,400 kilos.

Some 45,000 kilos. of lead were used for the joints; and the total capacity of the main is 3314 cubic metres (117,039 cubic feet). Eleven pressure tests, on successive portions, were undertaken so as to ensure the main being tight. They were made with compressed air at a pressure of at least 400 mm. (15·74 inches) of a column of water, and by observing the fluctuations of

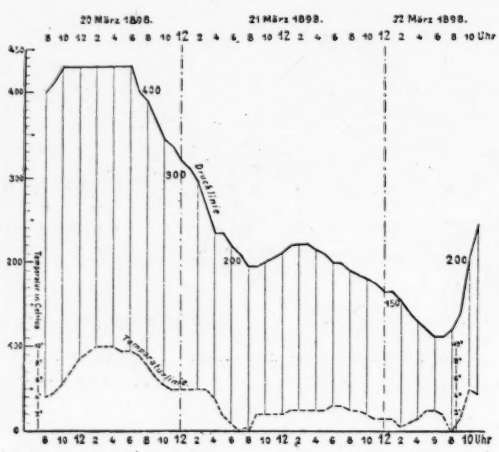


FIG. 40.—DIAGRAM OF A PRESSURE-TEST OF A 40-INCH MAIN IN INDUSTRIESTRASSE.

The length of main under test was 3230 feet. The vertical line of figures shows the pressure in mm. of water (10mm. = 4-10ths). The upper varying line (marked "Drucklinie") is the pressure curve; the lower one (marked "Temperaturlinie") is the temperature curve.

the temperature of the air and the barometric pressure. These tests were very satisfactory, in spite of the difficulties in laying several parts of the main. They were very strictly carried out, on account of the importance of the work, and the serious consequences which might have resulted from lack of tightness in the main. Fig. 40 shows the result of one of the tests; and the influence of the temperature is very clearly indicated.

Feeding Mains in the Town.

The working of the Riesbach and Enge works having to come to an end as soon as possible, a 600 mm. (23·62 inch) feeding main was laid in the town, starting from the 800 mm. (31·50 inch) leading main in Hardturmstrasse. This pipe of 600 mm. is laid up to the crossing of Brandschenkestrasse and Selnaustrasse. From here the pipe is divided into two—one half 500 mm. (19·68 inches) running towards the Riesbach works, passing under the quay bridge by means of three mains each 300 mm. (11·81 inches); the other of 350 mm. (13·78 inches) in the direction of the Enge works. These several mains can supply four times more gas than the old works were in a position to make. The bad state of the pressure was also considerably improved in the districts of Riesbach and Enge (formerly Seefeld). The total length of these mains is 7·2 km. (7874 yards). They were laid in eight months, and by the staff of the Gas Department.

H.—OFFICE BUILDINGS AND DWELLINGS.

The building intended for the administration of the works includes, on the ground floor, the technical and commercial offices. On the first floor, there are living rooms for the superintendent of the works; and on the second, for the assistant-manager, or eventually for the manager. The foreman has a separate house.

A stable for the horses and a house for the carts have also been built, because the cart traffic between Schlieren and Zurich is very important, and, one may say, incessant. It may be added that the Direction des Travaux is considering the building of workmen's houses, with board and restaurants for the men. They have submitted plans and proposals to the authorities for a final discussion.

I.—MATERIALS AND TESTS.

It has already been said, in describing the railway-sidings, that a temporary line had been made for the erection of the works. The cost of putting down this line amounted, in round figures, to about £1600. The traffic on it has been very important, as the following figures will show. About 5000 waggons of erecting material were brought into the works yard, made up thus:—

	10-Ton Waggons.		10-Ton Waggons.
Cement	331	Freestone	624
Lime	95	Cut stone	80
Paving-stones	108	Granite	150
Fire-clay goods	392	Embanking earth	207
Bricks	330	Stone ballasting	16
Cement bricks	50	Wrought and cast iron, and apparatus	536
Asphalte	12	Pipes	150
Gravel	331	Coal	180
Sand	384	Miscellaneous	1004
Tiles	17		
Earthenware and drain pipes	23		

Materials such as gravel, sand, stone, timber, tools, &c., which were not able to be brought by railway, must have amounted to about 20,000 cartloads.

The weight of the iron is 7366·4 tons (metric) including:—

2500 tons of constructional ironwork.
340 ,, of railway material.
2005 ,, of the Schlieren-Zurich main.
2500 ,, of cast-iron pieces, such as columns, windows, pipes, apparatus, and machinery.

The examination of the supplies of cement was done in the Federal Testing Material Department, by 9 complete tests, and 292 for resistance.

The Direction des Travaux themselves carried out 350 tests. The lime used was also proved in the testing-room above mentioned by three complete tests and 90 resistance trials; while the Direction on their own account made 50 others. Tests on the quality and resistance of the constructional ironwork were made either by the Direction des Travaux themselves, or by an accepted engineer on the contractor's premises. There were 370 deflection and breaking tests. Lastly, it may be said that no cast-iron pipes were accepted by the works without having been tested to a pressure of 15 atmospheres.

More than 200 firms carried out the work, and supplied goods for the erection of the new gas-works at Schlieren. Although some of the buildings were not altogether finished at the time this description was written, and a definite account had not been drawn up, the approximate cost of the different plant is given below:—

	Francs.		About
I.—Purchase of land	207,000	..	£8,280
II.—General expenses of management and superintendence of works	165,300	..	6,612
III.—Buildings	1,799,000	..	71,960
IV.—Foundations	160,000	..	6,400
V.—Leading main, Schlieren-Zurich	454,300	..	18,172
VI.—Railway-sidings	204,900	..	8,196
VII.—Plant (retort-arches, apparatus, &c., &c.)	3,018,400	..	120,736
VIII.—Interest during erection. Miscellaneous	161,100	..	6,444
Approximate total of works	6,170,000		£246,800

K.—GENERAL.

The first portion of the works (with two sets of apparatus), which has been finished, has been arranged for a daily make of 50,000 cubic metres (1,765,000 cubic feet) of gas. Several buildings have been erected, as has already been said, of a size sufficient to allow, without other additions, of putting in the plant required for a make of 100,000 cubic metres (3,530,000 cubic feet) per day. The very fully reckoned retort-arches, the adequate gasholder capacity, the engines, and the reserve apparatus, however, permit of making at the present time, without difficulty, 65,000 to 70,000 cubic metres (2,295,000 to 2,472,000 cubic feet) of gas per day, instead of the 50,000 cubic metres anticipated.

The great use of gas at present, either for lighting (thanks to the Auer burner) or for heating and cooking, or also for motive power and other technical purposes, obliges gas manufacturers to supply it both of good heating power and cheaply. Ten or fifteen years ago, there was a demand for gas of a high illuminating power—that is to say, containing much hydrocarbon. This is no longer necessary, because too rich gas blackens the Auer incandescent mantles, and causes them to lose a part of their lighting power. Several towns on the Continent, where the gas-works had become too small, have been able to make up with installations of water gas, which would not have been the case if a richer gas had been demanded. Water-gas plants have been in existence, in fact, for a long time in America and England, where, however, the circumstances are very different from our own. Technicians admit that from 20 to 25 per cent. of carburetted water gas can be mixed with illuminating gas. Experience, up to the present, has not shown any inconveniences from such a mixture. Between now and the time when the daily consumption of gas in the town of Zurich has reached from 65,000 to 70,000 cubic metres (or the

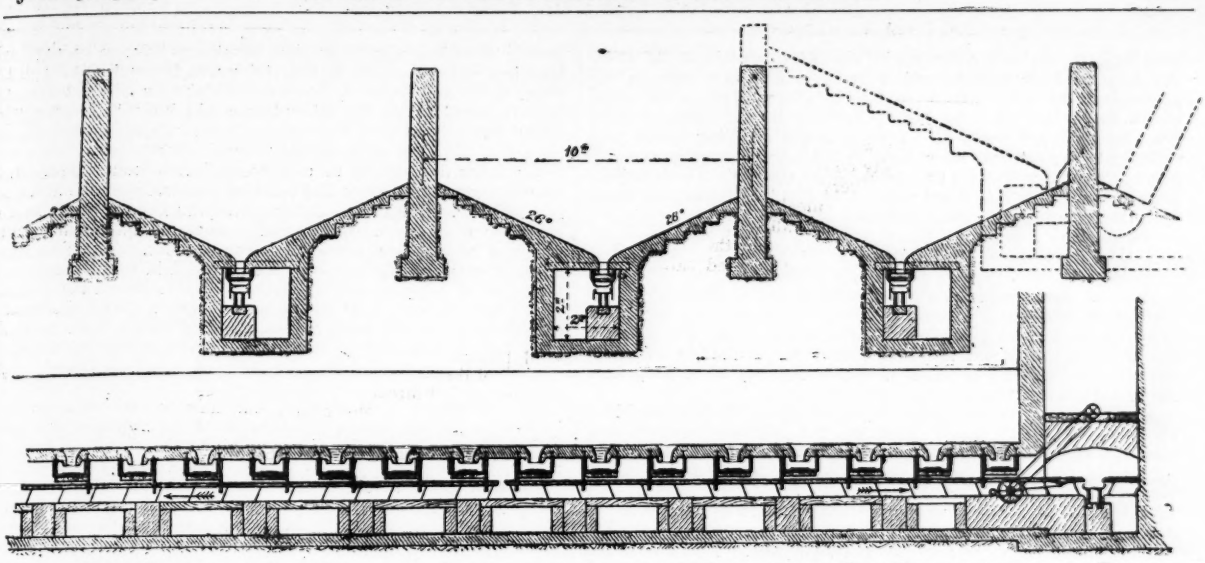


FIG. 41.—CROSS SECTION OF COAL SHEDS, AND LONGITUDINAL SECTION AT FOOT OF ONE COAL-SHED, SHOWING THE DISCHARGE OPENINGS (4 METRES APART) AND THE CONVEYOR, OF A CAPACITY OF 15 TONS PER HOUR.

[The dotted lines at top right-hand corner show a modification suitable for small gas-works.]

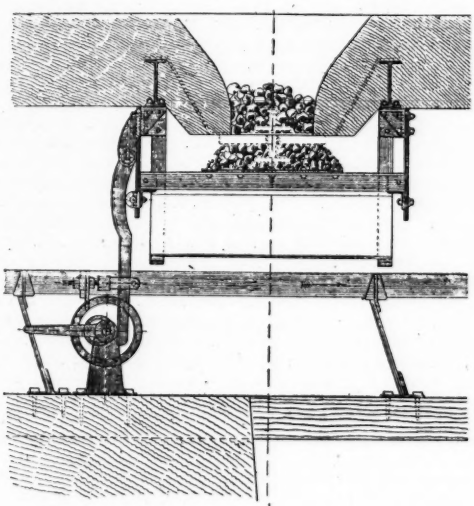


FIG. 42.—LONGITUDINAL SECTION, SHOWING DETAILS OF OPERATING MECHANISM.

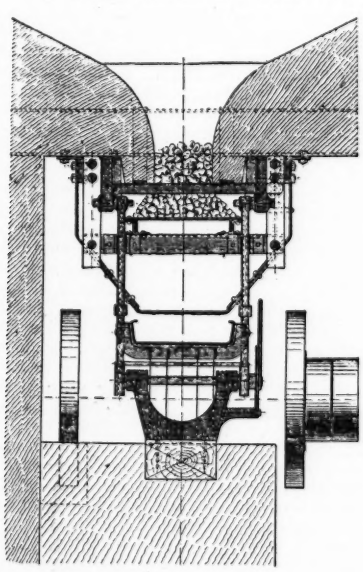


FIG. 43.—CROSS SECTION, SHOWING DETAILS OF OPERATING MECHANISM.

maximum capacity of the new works), progress will doubtless have been made; and the results of experience regarding the supplementing of coal-gas works by water-gas plant will have been brought together. One will, therefore, then be able to study the question of an installation of water-gas more closely, in order to provide for our works having the capacity of making 100,000 cubic metres of gas per day.

A loan of 8 million francs (say, £320,000) was granted for the new gas-works by a decision of Feb. 7, 1897. The first sod was turned for the buildings on Aug. 28, 1897; and gas was sent out into the town on Nov. 20, 1898. Since Sept. 1, 1899, operations at the three old gas-works have been stopped. The new works at Schlieren from that time have been sufficient alone, so that it will be possible in a year to give particulars of the return of this undertaking. It has already been ascertained, however, that considerable saving has been realized in the handling of coal, and that, in particular, the retort-benches are capable of producing more gas than had been anticipated.

DETAILS OF COAL AND COKE CONVEYING PLANT AT ZURICH.

As a supplement to the description of these works which is completed to-day, we give below an abstract translation of a paper read by Herr Weiss, the Manager of the works, at last summer's meeting of the German Association of Gas and Water Engineers, on "Coal Conveying Plant for Gas-Works." The paper has been published in a recent number of the "Journal für Gasbeleuchtung."

It is intended, in this paper, to deal with the question of the transport of coal and coke on gas-works only generally, and, except in a few instances, without reference to details of construction. The mechanical transport of coal is by no means a new development. It has been practised in America, and subsequently in England, for a long time. After adoption in railway-yards and coal-wharves, the use of coal-conveying plant spread to gas-works. The reason of the rapid development of mechanical methods of transport in America was principally the relatively high wages obtained there; but this reason was undoubtedly supplemented by others—such as the distances to be traversed, the varied nature of the stores and harbours, and the practical genius of the American for such devices. Notwithstanding, however, the examples that were set in America and England, up to a few years ago mechanical transporting plant on a large scale had not found its way into Continental gas-works. Mechanical methods were much more rapidly adopted in other industries; and the reason why conveying machinery was not so soon employed in the gas industry, appears to have been that the cost of the plant was apparently very high, and the wages paid on the gas-works were relatively low until recent years. Lately, however, matters have changed. Wages have risen immensely; the class of labour obtained has deteriorated; there is a much greater risk of strikes; while the working-shifts have been reduced in length. Hence gas-works of moderate size have been compelled to emancipate themselves as far as possible from the thraldom of manual labour, especially as at some times of the year the quantities of coal to be dealt with are enormously increased, and large numbers of temporary unpractised hands would then be needed if manual labour alone were available.

In most cases, mechanical conveyors are required either for transporting the coal from the railway or river wharf, where it is delivered, to the stores or coal sheds on the gas-works or direct to the retort-house, or, on the other hand, from the stores to the retort-house. A third application is for the mechanical supply of the retorts themselves. Now and then, mechanical conveyors are used for all these purposes; sometimes for only two of them. The

installations are, however, rare, in which human labour is, so to say, totally eliminated—by which is meant the use of mechanical appliances for automatically conveying the coal from the coal-sheds up to the retorts. Every engineer should endeavour to keep before him this ideal of the mechanical handling of the coal right up to the retorts, when he is called on to design a modern gas-works. By reference to one example, the author will endeavour to show how this ideal can be attained satisfactorily from both the technical and financial point of view.

A.—Transport from the Place of Arrival (Railway Station or Wharf) to the Gas-Works.

Few gas-works are so near the railway station that no special method of conveying coal thence has to be considered; and there are very few indeed which are so fortunate as to be situated near the pit's mouth, so that the coal may be taken thence direct to the retorts. The latter class of works do not, of course, need sheds for storing coal.

As a rule, the coal has to be conveyed a more or less considerable distance. For small distances, the primitive method was carriage in sacks or other portable receptacles. These were succeeded by single-wheeled barrows, and two-wheeled tipping-carts or tumbrels; the latter drawn either by man or horse. The next step was to mechanical methods, such as the tramway or suspension line, with waggons of varied construction, but still utilizing man or horse for the motive power. These systems serve their purpose so long as there is no great difference of level between the points of loading and unloading. But when there is a considerable difference in the heights of these places, the conditions become more favourable to mechanical traction, with steam, water, gas, or electricity as the motive power. The most favourable case is that in which the wharf or station is higher, or at least not lower, than the unloading place on the gas-works. The cheapest method of working is that in which the waggons can be drawn on a track of the standard gauge, by means of points and turntables, direct to the coal-sheds. At the coal-sheds, the waggons are generally unloaded by manual labour; but in one large works they are discharged by tipping. The requisite mechanism for this purpose, however, entails a great expenditure of power; and the working consequently becomes costly. For this reason, several attempts have been made to procure the transport of coal to the gas-works in the hopper-waggons which are used at the collieries. The demand for such waggons is very great, not only on the part of gas-works, but also of other large industries; and the managements of the collieries and railway lines have been approached with a view to their provision for the transport of the coal. But a long time must, unfortunately, elapse before this consummation is likely to be attained.

When the gas-works lie lower than the railway station, the methods of taking advantage of the fall to effect the transport of the coal do not require to be dilated upon here. But when the works stand higher than the station, all types of devices for raising the coal must be considered—such as elevators, and steam, hydraulic, and even electric cranes. These arrangements may be either at the station or at the works. For distances up to 220 yards, rope or pneumatic tramways, Hunt's automatic railway, conveying troughs, bands, chains, and conveyors of all kinds are available. For greater distances—to (say) 550 yards, and upwards—practically only locomotives have to be thought of; for they have the advantage that waggons, either empty or loaded with bye-products, can be conveyed back over the same line by the same means. The only other available method for great distances is the rope-line; but this does not serve so advantageously for sending back bye-products.

The cost of constructing and working these methods of transport depends very greatly on local conditions and what power is available. It is certain that, for small distances, elevating appliances are costly, particularly if full railway waggons have to be raised. The different types of small elevators become cheaper, and especially there must be mentioned Hunt's appliances—such as Hunt's elevator and Hunt's automatic railway—which came to us from America, because, having regard to their very great capacity, quite unimportant initial expenditure and working expenses are entailed. Horizontal transport to small distances entails much the same first outlay. In actual work, the replacement of cables and links of chains has especially to be taken into account, as the numbers worn out are very great in proportion to the quantity of coal conveyed. For greater distances, the use of locomotives, or where practicable small steam-boats, is extremely cheap.

B.—Transport of Coal from Stores (Coal-Sheds) to Retort-House.

A provident administration will always keep in store coal sufficient for at least one, two, or even three winter months' requirements. The scarcity of coal during the past winter has shown that this precaution is fully justified. The necessity for an ample reserve of coal has been proved by recent experiences, both in Germany and other countries. After the coal has been brought by one of the many available ways to the store, the most advantageous method of transferring it to the retort-house must be considered. Here, also, distinction must be made between the three cases distinguished by the relative position as regards level of the coal-sheds and the retort-house. Most frequently the floors of the two houses will be on the same level, especially in small and moderate sized works; and in these instances hand-barrows and quite simple methods of transport—such as trolley lines—will be used. But when a great number of settings have to be regularly supplied, either directly by the stokers or indirectly through the filling of storage-hoppers, &c., some differences of level between the coal-sheds and the retort-house will have to be grappled with; and mechanical arrangements are unquestionably called for. For the purpose, conveying troughs, bands and chains, and every other description of conveyors, have been suggested, in combination with bucket and other elevators, hydraulic and electric lifts, &c. Spiral and screw conveyors need a great deal of power to work them, and are not well suited for dealing with a material which is in lumps and small pieces. The first class of conveyors are suitable only for material in small pieces, and therefore, if selected, determine to a certain extent the position of the coal breaker or breakers on the works. When the coal is carried direct to the retort-house, the coal-breaker will be at the place where the coal is unloaded. Other coal-breakers will be required in suitable places for the coal which is stored in the sheds.

It has, indeed, been asserted that it is not advisable to store broken coal in large quantities, because of loss from dust and slack, and from the small make of gas obtained therefrom. These disadvantages, if real, appear to be completely eclipsed by the advantages afforded by mechanical transport. On the other hand, the latter advantages must be secured in the highest possible degree. The coal-sheds and conveying apparatus must be so arranged that, while in the first place the coal-sheds are filled by mechanical means, and in the second place the coal so stored in them is conveyed mechanically to the retort-house, there must be no manual labour employed to put the coal in the sheds on to the conveyor. In other words, the coal must be picked up automatically in the sheds.

The author is unaware of any gas-works, except his own, in which the coal is conveyed entirely automatically from the coal-sheds to the retort-house by the application of one source of power. It will, however, be rightly replied that, though theoretically automatic working is quite conceivable, yet practice shows that such automatic appliances do not always act well. The mistrust of them is based on the fact that ordinarily they are very complicated. Happily this is not the case in the author's works, where the apparatus leaves nothing to be desired in point of simplicity; and, in consequence, it works with precision and certainty. The automatic discharge of the coal-sheds is effected by constructing the floor so that it is inclined at a sharp angle—in this instance, 26°.

The construction of the apparatus can be seen from figs. 41, 42, and 43. In the bottom of the coal-sheds there are, at distances of 4 metres (about 13 feet) apart, openings of rectangular cross section. A little distance beneath each outlet-opening is a slab or table, somewhat larger than the opening. The material which runs through the latter rests on the table, and spreads nearly to the edges of the latter, according to the slope at which it rests. If the table is now set in motion by shaking it to and fro, the material runs regularly over the sides. This automatic delivery of the material proceeds as long as the table is agitated. The apparatus can be so arranged that the quantity of material delivered from the holder can be diminished or increased either by varying the shaking motion or by altering the distance of the table from the outlet-opening. The table is carried by a frame hung on four springs. Movement is imparted to the table through the conveyor trough which is below it. To the trough is attached an adjustable iron pin, which turns slightly, and strikes on a lever which turns about its bolts. This lever is connected by a hinged joint with the frame of the table. If the conveyor trough now moves to the right, for instance, the table follows the movement, and is brought back by the force of the springs to its initial position. The material delivered is guided by iron or wooden sides on to the conveyor trough.

If the table is not required to work, the lever is put out of reach of the afore-mentioned striking-pin. When the table is at rest, the material is kept back. Under some circumstances, it is convenient to be able to put the table in or out of operation while the conveyor trough continues to move. For this purpose, there is attached an eccentric provided with a handle. By turning the lever over through 180°, connection between the striking attachment on the conveyor trough and the upper lever can be made or broken. In order to be able to regulate the quantity of material delivered through the opening, there is attached to the latter a short tube, which can be raised or lowered by suitable means so as to put the lower opening of the tube any desired distance from the table, and thereby alter the section of the free space between the outlet opening and the table through which the material could pass. The same object can also be achieved by raising or lowering the table by suitable means. This method of distributing the material can, of course, be equally well worked directly or by means of any other type of conveyor.

The apparatus might be modified in regard to the opening; but no gain would be secured thereby. Its advantages consist in the possibility of taking coal forthwith from any part of a coal-shed at any time. It will entirely empty a coal-shed, provided the openings are at every 4 metres (about 13 feet) apart. A further advantage is that the coal which was first shot in the shed is that which is removed first for carbonization; and, moreover, as coal usually heats up first in the lower layers, in the event of the heap taking fire, the coal can be rapidly and conveniently removed from the seat of the fire and thereabouts. Repairs and wear and tear of the apparatus are practically *nil*, as

two years' use of it in the author's works has proved. It could be made in any suitable size for the quantity of coal that has to be dealt with.

Passing on to the retort-house, the method of storing up the coal there assumes great importance. For example, there are many instances of large receptacles, capable of holding a quantity of coal, placed at convenient spots—ordinarily where the coal is discharged from the elevators—well above the top tier of retorts. The coal is delivered from these receptacles, or central storage reservoirs, into small vessels, which are moved on an overhead or other line by manual labour to the retorts which are to be charged. Where machine stokers are used, the central receptacle fills the large reservoirs on them, each of which contains enough coal to charge a great number of retorts. The central storage reservoir has, however, the disadvantage that much time is taken up in covering the ground between it and the retorts; and there is also the cost of conveying the coal over this distance. In order to overcome this fault, the coal reservoir has been disposed along the front of the bench of retorts, and made of such a size that it stores 24 hours' supply. This arrangement offers the advantage of economy of the stokers' time and labour, and of continual preparedness for working. The charging-machines consequently can be lighter, more readily moveable, and cheaper, as they require only small coal receptacles attached to them. The long coal reservoir is, of course, filled by mechanical means; any of the usual conveying bands, troughs, &c., being available, though the push-plate or scraper type of conveyor offers special advantages for the purpose. The chains and plates composing it must be very stout. The work goes on automatically with this type of conveyor; for after the first reservoir is filled, the coal slides over coal without any considerable resistance from friction. In order to assure himself on this point, the author made exact brake tests, and found that an elevator and scraper type of conveyor running empty required 6¼-horse power; while in full work, and dealing with 15 tons per hour, 7-horse power was required, or only ¾-horse power more.

After the coal has been brought in front of the retorts, it has to be transferred into them. There are many ways of doing this—*e.g.*, with the shovel, with the scoop for manual labour, by charging machines of various types, worked either by manual or mechanical power; or (with inclined retorts) by coal-hoppers easily manipulated by a single stoker, as patented by Riegel. It is, however, absolutely essential that the operator should be able to control both the weight of the charge and its disposition in the retort, according to the heats of the settings and the size and degree of moistness of the coal. Consequently, purely automatic charging of the retorts should not be aimed at.

For the sake of completeness, a word must be said on the transport of coke, which is likewise of considerable importance. The transport actually is almost entirely done by hand. The coke which falls from the retorts is caught in barrows or trucks, partially quenched, and removed to the coke-yard, where it is dealt with. Several installations, however, prove that the work can be done without difficulty by machinery, whether the carbonizing plant consists of horizontal retorts, stoked either by hand or by machines, or of inclined retorts. Perhaps the latter case is the one in which the mechanical transport of coke is most readily applied. The apparatus commonly used is the well-known De Brouwer's trough conveyor, which comprises a trough filled with water, in which move iron chain-links and rods forming a kind of step-ladder, which may be driven by any convenient power. Band conveyors have also been employed for the same purpose.

Numerous improvements have been made in the De Brouwer conveyor since its first appearance, as the results of practical experience of it. At the present time, it can be safely asserted that it is the best accredited, most suitable, and cheapest means for the transport of red-hot coke. It is unnecessary to refer in detail to the numerous advantages of this conveyor (among which the hygienic benefits it confers on the workmen are specially conspicuous), as they are well known. It is impossible to lay down any general scheme for the transport of coal and coke on gas-works; the choice of the method employed, and the disposition of the apparatus, must be made dependent on local conditions.

The financial aspects of mechanical transport have still to be considered; but here also it is not possible to give any general review of the cost of erecting and working such installations. Many reports as to particular cases have, however, been given in the "JOURNAL," and the saving realized by their use recorded. Generally speaking, they show a very satisfactory economy; and the author ventures to say that in any special case where this is not found, the incidental advantages of the machinery will be so great that it will not be discarded. Some figures of the cost of operating at the Zürich works may, however, be stated here. The transport of coal from the Schlieren station to the gas-works should be omitted, as it is disproportionately heavy, on account of the distance, which is 1200 metres (1312 yards). Locomotives, of course, are the cheapest means for this work; and actually 10 tons (metric) of coal are conveyed to the point where it is shot on the works for 1s., inclusive of 4 per cent. for interest and 2½ per cent. for amortization, and of all charges for wages, fuel, lubricants, repairs, &c. If allowance is made for the bye-products sent away, the cost of transporting the coal works out at 1od.

The unloading of a waggon of coal, and transfer by hand-labour to the coal-sheds, used to cost 3s. 7d., or, if done by piecework, 2s. 9½d. It occupied a strong, experienced labourer 3 to 5 hours. Now, using Hunt's transporting apparatus, the unloading and storing of 10 tons (metric) of coal costs 2s. for nuts and small, or 2s. 2d. for large coals, which have to be dealt with in the coal-breakers. In this computation, interest is reckoned at 4 per cent.; amortization—on buildings at 2 per cent., and on machinery at 12 per cent.; fuel, repairs, and lubricants at 2 per cent., and wages—labourers 3s. 6d. per diem, and fitters 4s. to 4s. 2½d. per diem. The expenses with manual labour were about £900 per 5000 waggons dealt with per annum; and now, with machinery, they are only £480, which is a saving of 46·5 per cent.

Still more favourable is the present cost at Zürich of conveying coal from the sheds to the retorts. In well-managed gas-works of moderate or large size, the cost of transporting coal amounts to 4s. per 1000 cubic metres (35,300 cubic feet) of gas made; and consequently, for an annual make of 12 million cubic metres (about 424 million cubic feet) to £2400. But with the coal conveying machinery in use at Zürich, the transport of the coal costs 1s. 11d. per 1000 cubic metres of gas made, or £1160 for an annual make of 12 million cubic metres—that is to say, 51·7 per cent. less than the general cost. Though these figures refer to works of large or moderate size, the conveying machinery would certainly effect a considerable economy in works making (say) only from 90 to 105 million cubic feet per annum.

Finally, the following general conclusions may be drawn with reference to the transport of coal and coke on gas-works. The requirements or conditions to be fulfilled are:

(1) The transport of the coal must proceed automatically by machinery from the railway waggons to the retorts, by means of other than animal power.

(2) Gas, water, steam, or electricity may be the source of power. Electricity, however, is the most suitable, as electro-motors are specially fitted to work in places where there is much dust and smoke, and also need but little inspection.

(3) If cheap electrical or water power is not available, it is best to raise steam for the production of electrical power by burning coke breeze on the Kudlicz or Perret grate.

(4) Only small coal or nuts can be dealt with by conveying plant; hence large coal must be broken before it is stored.

(5) The machinery must be simple and strongly constructed, so that it can be readily attended to by any workmen. There must be few parts exposed to wear; and the lubrication must be effected in as simple a manner as possible.

(6) Unnecessary machinery must be avoided.

(7) From this last condition, it follows that settings of inclined retorts are best adapted for working by machinery.

(8) With each type of coal conveying apparatus, an adequate reserve plant must be provided, in order that there may be no interruptions of the work.

(9) The coke, moreover, must be transported by machinery as soon as it leaves the retorts.

The results attained are as follows:—

(1) Working, which is quite independent of the favour and whims of the staff of workmen. In times of epidemics, war, or strikes full work can be maintained with a mere handful of untrained men.

(2) Simplification of working, great reliability, and increased productive power.

(3) Decrease in the number of workmen, and lighter work. The workmen secure more intervals for rest, and their work can be properly done if they attend for ten hours a day—actually working for about 5½ hours only. Thus the eight-hours day, which is claimed on social grounds, may be regarded in years to come as purposeless.

(4) The stokers are in no way concerned in the transport of the coal, and therefore are at liberty to devote greater attention to the settings.

(5) All coal transport is discontinued at night, as it is finished in a few hours in the day time.

(6) Gas-works having a minimum daily make of 3000 cubic metres (nearly 106,000 cubic feet) of gas may unhesitatingly adopt mechanical transport of coal and coke.

(7) It has been demonstrated that simple means of forwarding coal are perfectly practicable from the technical standpoint, and moreover, are attended with the greatest financial advantage.

This communication embodies the results of exhaustive study and numerous trials, and is based on practice and not on theory. The results have been fully substantiated by two years' operations at the Zürich Gas-Works.

In conclusion, it may be pointed out that the considerable economies effected by the use of mechanical conveyors for coal and coke will enable greater support to be given to benefit schemes; and the social welfare of those employed will thus be furthered in the manner advocated last summer by Herr W. von Oechelhaeuser in his Presidential Address to the Association, and subsequently noticed in the "JOURNAL."

Institution of Gas Engineers.—In consequence of the funeral of Her Majesty the late Queen being fixed for Feb. 2, the annual general meeting of the Institution (which had been announced to take place on that day) has been postponed to the following Saturday, at the offices, 11, Victoria Street. As in previous years, the proceedings on this occasion will be purely formal—the principal item being the election of President, Vice-President, and members of Council to replace those retiring by rotation. Thereafter the meeting will be adjourned to May 1 and 2, when the proceedings will be continued at the Institution of Civil Engineers.

NOTES.

Incandescent Mantles for Lighthouses.

In a letter to "The Times," a few days ago, Professor Barrett, of Dublin, referring to the recent loss of the *Russie*, emphasizes the importance of having distinctive lights on lighthouses. In this connection, he directs attention to the powerful scintillating light invented by Mr. John R. Wigham, which, he points out, can be easily installed in an isolated spot. The burner consists of a series of concentric rings of very large incandescent gas-mantles, fed with petroleum vapour burnt at a high temperature and pressure; the naked mantles attaining their full brilliancy without an encompassing chimney. Round the burner, which can be made of greater or less power according to the opacity of the atmosphere, a system of eight annular lenses of large size is made to revolve, at the speed of one complete revolution every four seconds. Thus two flashes per second fall upon the eye, the effect on which, Professor Barrett says, is "a series of throbs" closely resembling the sensation produced on the ear by a succession of rapid and loud musical "beats." He made some observations from his house at Kingstown, when the light was being shown on the roof of a house in the heart of Dublin, six miles off; and he states that in clear weather it was never lost to the eye, while in thick weather, owing to the uniform brightness of its scintillations, it preserved its distinctive character, though it was dimmed. The chief merit of the light, however, appears to be its remarkable power of arresting the attention of the mariner by a rapid succession of "shocks" to the eye, caused by the throbbing of a brilliant beam of light, whereby a striking individuality is given to the system. Sir Robert Ball, F.R.S., has reported favourably upon the light.

New Uses for Calcium Carbide.

It is stated in the "Engineer" that some new uses have been found for calcium carbide. First among these are two different methods of making lamp black from the combustion of acetylene. In the first, the acetylene is burnt with an insufficient supply of oxygen, and the soot is collected in the ordinary way. This process, therefore, does not differ essentially from the methods of making lamp black from oil or tar, and only a portion of the carbon of the acetylene is collected in the elemental condition. The second method consists in exploding the acetylene contained in a cylinder under moderate pressure, which results in complete dissociation of the gas into hydrogen and carbon. The acetylene to be thus treated is pumped into a suitable receiver under a pressure of four atmospheres, and a spark is passed from platinum terminals. The pressure momentarily rises to 24 atmospheres, which falls again to 4 atmospheres; for four volumes of acetylene yield four volumes of hydrogen. The hydrogen is run off into a holder, and the receiver is found to contain a black containing 99·8 per cent. of carbon. This powder is said to be absolutely black, and to be wholly free from grease. The remarkable feature of it is that it is comparatively cheap—costing, it is said, 4d. per pound; while ordinary process lamp black of equal purity costs 5d. per pound. Dr. A. Frank, of Charlottenburg, proposes to mix the acetylene first with carbon monoxide or carbon dioxide. With the former, the whole of the carbon of the two gases is recovered. It is not even necessary to make acetylene, the calcium carbide answering the purpose equally well. The physical properties of the carbon recovered depend upon the temperature and pressure maintained during the process. The product may range from a material fit for use as a pigment, or in the manufacture of printing ink, to a hard crystalline graphite.

Methods of Preserving Iron from Corrosion.

A French method of glazing iron pipes and other articles intended to be placed underground is thus described in the "Ironmonger." It is claimed that the metal is perfectly protected from all corrosive influences in this way. The glaze is made of a mixture of 20·5 parts of soda, 12 parts boracic acid, and 130 parts of powdered white glass. These components are intimately mixed, and then fused in a crucible. Afterwards the compound is plunged in water and then again ground to a fine powder. The iron must be perfectly clean before commencing the operation of covering with the powder, and is prepared for it by brushing over with any sticky substance, such as a solution of gum arabic or fine glue. The powder is then dusted over the surface, and after drying the articles so treated are raised to a dull red heat, when the coating fuses and sets hard on cooling. It then offers an extraordinary degree of resistance to any oxidizing or other deteriorating influences. The process is admittedly rather complicated, and is probably more expensive than the usual iron preserving processes followed in this country; but since the result is stated to be complete and permanent protection of the iron, it is possible that for some purposes the trouble and cost are well paid for. The effect of the treatment when properly carried out is to make iron pipes, so far as cost is concerned, like earthenware. Another iron preserving process practised on the Continent, but more often employed for treating small ironwork than for underground structures, is an electric method of producing a surface of the black oxide of iron. The articles are put into a bath of distilled water at a temperature of about 172° Fahr., and a current is passed through the bath just strong enough to decompose the water, so that the hydrogen collects at one pole. Afterwards the articles will bear polishing and have a very effective appearance.

COMMUNICATED ARTICLES.

BUSINESS SKETCHES IN AMERICA.

SOME METHODS WORTH EMULATING.

By E. W. T. Richmond.

"Much matter to be heard and learn'd."

* * * * * * * *

"Give me leave to speak my mind."

"As You Like It," Act. v.

An Introduction and an Acknowledgment.

As I sit down to commence this series of articles on possible points of interest to the gas industry, gathered in America during a brief sojourn in that hospitable country at the close of last year, I feel somewhat appalled by the pile of notes, correspondence, and printed information that lies before me, all more or less bearing upon the subjects which I propose to introduce. But every note, letter, leaflet, or book, recalls to remembrance the unbounded cordiality and kindness with which I was received and treated here, there, and everywhere during my journeying over some three or four thousand miles in that great progressive country, and particularly at the hands of the American and Canadian gas profession. Though a stranger, yet the link which unites me with the English gas industry was sufficient to open the door and ensure a hearty reception wherever I went; and the consequent happiness, pleasure, and instruction which I derived, and which caused the days to pass all too quickly, "are in my memory locked."

A Little Regret.

In a technical paper such as the "Journal," the topics over which my pen may traverse are almost rigidly circumscribed. The magnificent sights I saw (some almost inspiring awe in their great natural splendour), the large tracts of virgin country, which open up a vista of illimitable development, the immensity of the work already accomplished, the stately buildings, the scenes of events which have helped to mould the land of our cousins into what it is at the present day, all set me longing to transgress the editorial rule. But I must forbear.

By Way of Preface—Where we Excel.

In approaching the subjects with which I purpose dealing, I desire to say distinctly that I intend to carefully shun any expression of opinion on purely gas engineering or manufacturing questions; and the information touching thereon which I have to offer shall be imparted as I received it. I will with Othello—

"Nothing extenuate, nor set down aught in malice."

But on subjects affecting the branch of the industry with which I am more intimately acquainted, I may venture a little further afield. Without, however, being charged with presumptuousness, I think I may go to this extent—and I do so in the kindest spirit, and entirely as an interested, and I hope observant, onlooker—that I cannot concede to our American friends a pre-eminence in their coal-gas manufacturing plant and financial arrangements over English methods. That we are certainly in the van in these respects is conceded by our Transatlantic relatives. The coal-gas plant in America is not by any means on a level with ours; and in the adoption of systems approved on this side, and known and employed for their economical working, American engineers are in arrear. But to the recent great International Congress, and to the opportunity which it gave to many of them to personally investigate in actual work the newest plant in this country, I look with confidence for a big and immediate step on the path of progress in this direction. In the works I visited, of inclined retorts there were none; and the operation of the stoking machinery which I saw impressed me as being infinitely inferior to that of the West and Arrol-Foulis types. These are two lines along which, I think, superior working might be achieved "over the way." Others might be mentioned, but I have already stepped too far across the bounds which I have set myself. The gas men of America, however, whom I had the pleasure of meeting will not, I am certain, allow themselves to long remain under the imputation of being backward in these regards.

What we may Learn.

Having thus delivered myself in favour of my own country, I am impelled, by what I saw unaided, and by the proofs which my good-natured and communicative friends brought to my notice, to turn round and confess that there are many of their methods which the managerial section of the gas industry at home could study and adopt with profit to their undertakings. I refer particularly to the commercial side of the gas business, and to the relations of the supplier and consumer. In the keenness of our American friends for securing new custom, I confess, with a feeling of humiliation, that we on this side are not their equals. Whether for lighting, cooking, heating, or motive power, they do not leave a stone unturned in order to obtain extended business. The beating of the big drum may be objectionable to the fastidious at home; but when big results follow, what argument can be advanced in opposition? If, in America, bold advertising, constant circularizing, and other ordinary methods do not have the desired effect, then personal interviews are sought, and these frequently reach the end aimed for where other courses have been tried and

failed. If the first visit is not successful, the householder is left with the promise—

"Ere long I'll visit you again."

If, too, a man cannot be obtained for the trinity of the gas industry—lighting, cooking, and heating—then a pertinacious effort is made to obtain his adhesion to one of the three.

It is fully recognized in America that the expansion of the gas business is to be found in the fields of cooking and heating; and, so far so, that if a manufacturer of appliances for these purposes seeks to open up business relations with a gas manager, the first question the latter puts to his would-be supplier is "What amount of custom can you obtain for us?" And this, it seems to me, is a direction in which the gas supplier and the stove manufacturer can work together with mutual advantage quite as well at home as in America. But the mainspring to the opening up of their new gas consumption is advertisement in the daily press. Advertise! Advertise!! Advertise!!! is the leading idea of the gas manager; and where that is unsuccessful, then other means are brought into play to try to attain the wished-for end. But on this question of advertising more shall be said. Lost custom through lack of enterprise is a biting loss, for

"Griefs cry louder than advertisement."

I hope to include some interesting examples of advertisement from America. For the present, however, I leave the subject with the one remark that the great scheme of creation at the beginning of all things itself created the need for artificial light, but no need for day gas consumption. This must be cultivated; and how to cultivate it is well known and practised by our American friends.

Voyage and First Days in New York.

What I have so far written must simply be taken in the light of an introduction; and now I do not think I can do better than give an account of what I saw and heard in connection with the gas industry from the commencement to the end of my travels. The voyage to America, which began on Oct. 20, was taken in the good ship *Campania*; and "Profit Sharing" by Gilman (which has lately been extensively commented on in the "Journal") was my chief study during smooth portions of the journey. I consider this a very fine and exhaustive work; and it should certainly be in the hands of, and diligently read by, all who have the welfare of their employees at heart.

Oct. 26 witnessed my arrival in New York; and one of the first things that struck me on opening the "New York Evening Post" was the New York Gas Company's advertisement respecting the advantages of gas cooking-stoves. During my stay in the premier city of the States, I called on many people connected with the industry. One of the first was Mr. A. C. Humphreys, who stands at the head of the American gas profession. He occupies the fifteenth floor of one of the twenty-storey "sky-scrapers" which bulk so large in American cities. Then I went on to Mr. Cunningham, of the "American Gaslight Journal." The offices of this paper seem to me to be a kind of Liberty Hall to the gas fraternity. Visitors, I noticed, walked in and out without any formal or ceremonious announcement, and appeared to make it quite a "house of call." I have also to acknowledge the kindness of Mr. E. C. Brown, the Editor of "Progressive Age," who, by introduction and advice, considerably assisted me.

The Consolidated Gas Company.

To the Consolidated Gas Company of New York I must give an opening place, inasmuch as it was the first to come under investigation. This large concern (larger than the South Metropolitan, but smaller than the Gaslight and Coke Company) has been built up by the fusion of four Gas Companies: The Consolidated (which was as large as the other three combined), the New Amsterdam, the Standard, and the Mutual. The consolidation must have effected a great saving. All the Companies were at liberty to run pipes in each other's districts. The Consolidated Company practically had pipes all over New York, but the other Companies confined themselves to various districts; the result being that in many cases collectors and inspectors of the various Companies were going over the same ground, and many expenses of a like character were being duplicated and trebled through the competition which existed. The Consolidated, and all the other Gas Companies in New York, three years ago charged $1·20 for their gas. A law was then passed bringing the price of gas down 5c. per year; until next year it will be the level dollar. Gas supplied through prepayment meters cannot be charged for at higher price than that delivered through the ordinary meters; and this, I consider, to some extent, accounts for the laxity displayed in pushing prepayment meters in New York. In other States, the same retarding influences obtain; and little is done compared with the development under our methods in Great Britain. Incidentally, it may be remarked, the illuminating power of the gas in the city is very high—from 26 to 27 candles.

Competitors United.

It is interesting to note that the Consolidated Gas Company have absorbed the electric light concern. This has been a very far-reaching financial undertaking, and could only have been pulled through by such a captain of finance as the President of the Company, Mr. H. E. Gawtry, is acknowledged to be. His word is looked upon in Wall Street as his bond; and he has great influence in financial circles there.

Purchasing Agents.

The Assistant Secretary, Mr. L. B. Gawtry, the President's son, is the Purchasing Agent of the Company, and bids fair to follow in his father's footsteps. The Purchasing Agent is quite an institution in the States. Engineers recommend the purchase of various articles; and the Purchasing Agent looks into the prices and authorizes the purchase. Whether this dual control is advantageous or not in small companies, is a matter about which I am rather dubious.

Share Transfers and Values.

I was initiated into the rapidity with which share transfers are executed on the other side, and informed of the great improvement in the financial standing of this Company. Fifteen years ago, their $100 ordinary shares could have been purchased at $80, whereas now they stand at $190, yielding just over 5 per cent., in spite of the fact that the amalgamations have resulted in a large amount of watered capital having to be provided, which, had it not been for competition, would have been unnecessary. This Company, in common with many others, publish no balance-sheets, as they fear it may invite competition.

Two Officials.

Mr. A. Doane, the courteous and well-informed Secretary of the Company, who gave me the information in the foregoing paragraph, is known to several engineers on this side, to whom he has paid visits on some of his tours of investigation; and in Mr. Bradley, the Chief Engineer, I found a man whose opinion on gas matters is pregnant with strong common sense.

The Amsterdam Works of the Consolidated Company.

It was with much regret that I could only find an opportunity of visiting one of the works of the Consolidated Company—viz., the "Amsterdam" station. Its attraction for me consisted in the fact that it is entirely devoted to the manufacture of water gas; while the other works distribute a mixture of which three parts are water gas. The New Amsterdam Company (which absorbed the Equitable Company) was formerly looked upon by the Consolidated Company as a concern from which they had no cause to fear trouble on the Island of Manhattan, which is the chief island, on which the business portion of the city is built; but the Amsterdam Company, with an eye to expansion, decided to drive a tunnel under the East River from Long Island, where their works were situated, to Manhattan. They went down 135 feet, and drove a tunnel half a mile long (most of it through solid rock), and ran two 36-inch pipes in the tunnel—the whole constituting a very fine piece of engineering

The Tunnel under East River.

work. The tunnel, as seen by the illustration, has a cast-iron lining, made by the Davis and Thomas Company, of Catasanqua, Pa. From midstream a branch supply was carried from the trunk mains to Blackwell's Island, a small island on which New York City has built its prison, asylum, and other public institutions. The branch pipe is a 6-inch one. The Municipality then agreed, under contract, to cease manufacturing gas, and to take their supply from the New Amsterdam Company at 92½c. (which equals 3s. 8d.) per 1000 cubic feet of 27-candle power. This was a fair paying price for the New Amsterdam Gas Company, and represented a big saving to the city.

The New Amsterdam works cover 5 acres; and the additions which have recently been made reflect great credit upon Mr. A. S. Miller, the Engineer. Their capacity is 13 million cubic feet per day; and the land and buildings are so arranged as to enable the production to be increased to 24 millions. The capital outlay on the works only totals to 2s. per 1000 cubic feet, which, at 4 per cent., represents about 1d. per 1000 cubic feet, which is very moderate. This, of course, does not include cost of mains, offices, &c.—nothing but the plant and land.

Labour Saving in the Counting-House.

While at the Amsterdam works, I was much interested in a machine for totalling up bills, called the "Arithometer." This clever machine, while carrying out the single items of the gas consumers' accounts, also totals them up. A receipting machine likewise excited admiration. This gives a receipt, enters the amounts paid, and adds them up at the end of the sheet, so that the day's work is totalled as it progresses. Another machine was seen addressing bills on a sort of hard

tape; and this in a gas office must be a great labour saver. A font of type is used to set up the customers' names on the bills. They are put into a band; and the names are printed one after the other with great rapidity.

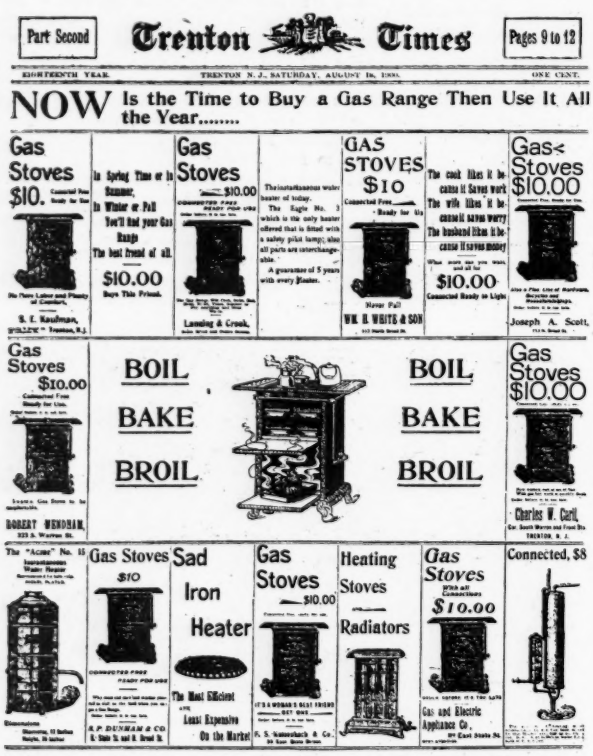
THE STOVE BUSINESS IN NEW YORK. At the offices of the Consolidated Company, samples of stoves were on view, displayed exactly the same as in many offices in this country; and some of the offices had special stove show-rooms, but they were not very attractive. Partly compensating for this were some striking coloured advertisements on the walls, pictorially illustrating the advantages of using gas-stoves. These cards, I understand, have also been prominently exhibited in the tramcars.

COLLECTION OF ACCOUNTS. It may be conveniently mentioned here that a custom of the country, and of most American Gas Companies, is to collect their accounts monthly, and in some cases weekly. This, again, is an impediment to the introduction of prepayment meters.

CHARLESTOWN GAS COMPANY, SOUTH CAROLINA. While in New York, I met the late Manager of this Company (Mr. J. T. Thomas), who is a native of Hyde, Cheshire. He informed me that, at Charlestown, stoves costing about 50s. are supplied at cost, and fixed free; piping up to 200 feet being supplied without charge. The price of gas there is about 5s. (or $1·25 per 1000 cubic feet for day consumption, and $1·60 for ordinary consumption).

A PROSPEROUS GAS-WORKS INVESTOR. I also had the pleasure of interviewing, in New York, Mr. Macmillan, a gentleman who has amassed a large fortune in ten years or so by buying up gas-works, and developing them and selling them again. He now controls ten separate works; some being as large as Derby.

TRENTON'S ENTERPRISE AND SUCCESS. About two-thirds of the distance on the road to Philadelphia is the town of Trenton, with a population of 75,000. Enterprise and an active Manager have there produced some most remarkable results in the rapid development of the stove trade. The Company's first effort in this direction did not meet with the return that it deserved. A start was made by lending, rent free, 300 stoves to big consumers; and in the following eleven months only 102 stoves were sold. The Engineer and General Manager (Mr. Frank D. Moses) was then given charge of this branch, and commenced to advertise freely; and something novel in the way of a newspaper advertisement which emanated from him is here reproduced. The illustrations are two pages of a four-page newspaper supplement occupied completely by the


Part Second

Trenton Times

Pages 9 to 12

EIGHTEENTH YEAR. TRENTON N. J., SATURDAY, AUGUST 18, 1900. ONE CENT.

NOW Is the Time to Buy a Gas Range Then Use It All the Year.....

Gas Stoves $10.

In Spring Time or in Summer, In Winter or Fall You'll find your Gas Range The best friend of all. $10.00 Buys This Friend.

Gas Stoves $10.00

Landing & Crook.

The instantaneous water heater of today. The Eagle No. 3 which is the only heater offered that is fitted with a safety pilot lamp; also all parts are interchangeable. A guarantee of 5 years with every Heater.

GAS STOVES $10

The coal likes it because it Saves work The wife likes it because it saves worry The husband likes it because it saves money $10.00 Connected Ready to Light

Never Fail

WM. H. WHITE & SON

Gas< Stoves $10.00

Joseph A. Scott,

Gas Stoves $10.00

ROBERT WEIDMAN,

BOIL BAKE BROIL

BOIL BAKE BROIL

Gas Stoves $10.00

Charles W. Cart,

The "Acme" No. 15

A. P. DUNHAM & CO.

Gas Stoves $10

Sad Iron Heater

The Most Efficient and Least Expensive On the Market

Gas Stoves $10.00

Heating Stoves and Radiators

Gas Stoves $10.00

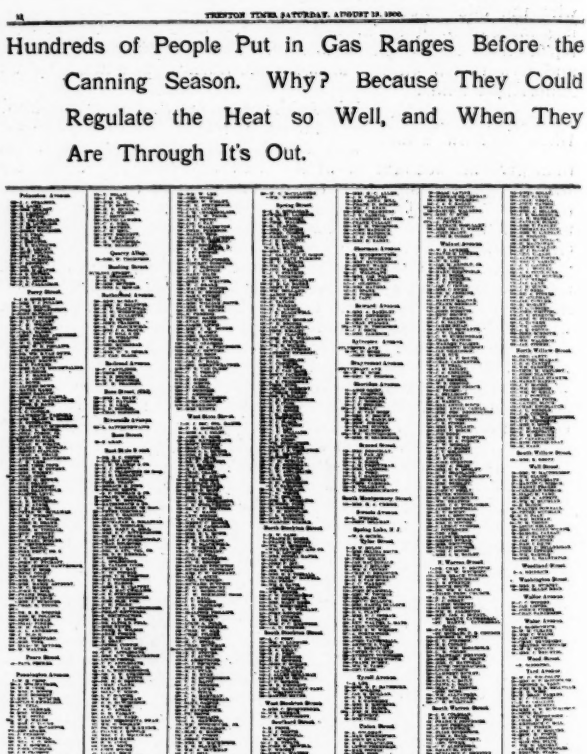
Gas and Electric Appliance Co.,

Connected, $8

The Virtues of Gas For Fuel!

Always Ready in Health or Sickness, in SPRING, SUMMER, FALL OR WINTER.

THE FIRST PAGE OF THE TRENTON COMPANY'S FOUR-PAGE ADVERTISEMENT.


TRENTON TIMES SATURDAY, AUGUST 18, 1900.

Hundreds of People Put in Gas Ranges Before the Canning Season. Why? Because They Could Regulate the Heat so Well, and When They Are Through It's Out.

THE PROOF OF THE PUDDING IS USING A GAS STOVE

THE FOURTH PAGE GIVING NAMES AND ADDRESSES OF SOME OF THE STOVE USERS.

(The Second and Third Pages contain Lists of other users.)

Company. The principle they have adopted in cultivating business appears to be that if a thing is worth doing at all, it is worth doing well. To secure a big expansion, one must draw attention; and to attract attention, something on such a scale that it will be talked about must be done. The hint should be taken by the gas authorities at home. Who among them has ever issued such an advertisement locally as the Trenton folks? But let us see what happened in Trenton. Almost entirely—I might perhaps, by including personal canvass, go so far as to leave out the qualifying word, and say entirely as the result of this liberal policy in advertising, no less than 2600 stoves were actually disposed of in three months. This is the greatest output, in such a short period for a town of the size of Trenton, I have ever heard of; and I commend the result to the serious consideration of my friends at home. In addition to the liberal advertising and a generous distribution of literature, a show-room was opened, and dealers in the ironmongery line were offered a commission of 10 per cent. on any orders they could take. But the Gas Company did by far the largest business themselves. The results were, as shown, most remarkable, especially when one considers that, in this part of the States, anthracite coal can be obtained, broken to the size of beans, for $4 per ton, which is equal to about 16s., and the best parlour coal for $5.75. This coal burns beautifully; and when once lit can be kept constantly alight, by proper adjustment of the dampers, for three or four months. However, the effect of this magnificent output of gas-stoves must have been a doubling of the gas consumption right away, as the Company had 100 per cent. increase next year. Mark this—100 per cent. increase!

A CURIOUS CONTRACT. The success of Mr. Moses at Trenton has secured for him some notoriety, and what will be considered here a very peculiar contract. The terms of the agreement are, in brief, that he has contracted with the Baltimore Gas Company to put out 20,000 stoves in twelve months under a penalty of $10,000, if he fails. A conspicuous advertisement announcing this contract to the residents of Baltimore has appeared in the local press; and I have a specimen in the "Baltimore American," Jan. 6, 1901. It measures 17½ in. by 11 in.; and on p. 271 is a condensed representation.

PHILADELPHIA AND THE U. G. I. COMPANY. New York I found was a vast source from which to draw pleasure and instruction; but fleeting time compelled me to be on the move. About a week after I first set foot on American soil, I found myself in Philadelphia. Striking as are the general features of this great city, the visitor who is identified with gas in other countries will be drawn to it by the fact that it is the home of that magnificent enterprise the United Gas Improvement Company. It is truly a remarkable concern, and is apparently twice as large as the Imperial Continental and the

20th CENTURY FUEL

GAS GAS

We take this opportunity to announce to our patrons that we have closed a contract with MR. FRANKLIN D. MOSES, of Trenton, N. J., to sell GAS STOVES and other appliances at cost price, and set up same free of cost to our consumers.

Mr. Moses will fully demonstrate to the residents of Baltimore the benefit, comfort, and economy of gas as fuel.

Respectfully,
CONSOLIDATED GAS CO.

GAS GAS

20th CENTURY FUEL

European Gas Companies combined, with the most energetic and up-to-date management. Their offices comprise one large block of buildings in one of the main thoroughfares in Philadelphia, twelve stories high. They own about forty gas-works of various sizes, large and small, up and down America, and have, in addition, a lease for thirty years (granted in 1897) for the supply of gas to the city of Philadelphia. This is a notable lease, inasmuch as the Municipality previously ran the gas-works, but unsuccessfully; whereas the United Gas Improvement Company in three years have increased the number of consumers by 100,000, and the sales of coal and water gas to 4000 million cubic feet. They

Offices of the United Gas Improvement Company.

have also undertaken to sell gas at $1 per 1000 cubic feet for the first ten years, at 90c. for the second ten years, and at 80c. for the last ten years, in addition to which they give the Municipality 10 per cent. of the profits of the undertaking under their management. At the time the contract was leased, there was an immense amount of opposition; to-day, the advantages accruing from the arrangement are such that there would be no difficulty in renewing the contract. The Company owe their success in a large measure to the magnificent business capacity and organizing powers of Mr. Alexander C. Humphreys, who in 1885 became the General Superintendent of the Company, with ten gas-works to manage; and he left the Company in 1894 splendidly organized, and controlling and working over thirty different works in various parts of the States. Mr. Humphreys is known to many engineers on this side, but will be known to all as the senior partner in the firm of Humphreys and Glasgow. Mr. Glasgow was frequently asked about. He has, in truth, left a wide circle of admiring friends among American gas men.

Chiefs Among Men. I was glad to make the acquaintance of Mr. Dolan, the President of this goliath concern; and instinctively I recognized that I was in the presence of a leader of men. His clear-cut features and the sense of reserve power with which he impressed me was quite invigorating. I found Mr. M'Kinley knew him well and favourably. Mr. Dolan is one of the largest shareholders in connection with gas concerns in the United States; and, in common with other Presidents, he puts in a daily attendance, and works continuously in the larger concerns of the Company. Some interest will be taken in the *personnel* of such a gigantic undertaking. An observer would be struck by the immense grasp of detail and power of concentration shown by the General Manager of the Company, Mr. Bodine. It is a wonder how his health stands the strain. Mr. Walton Clark, the General Superintendent, has given way under the pressure, and was in Europe recouping while I was in the States. I have during the last few days heard from him regretting that he missed seeing me.

Gas-Stove Business. The United Gas Improvement Company are most energetic in pushing the sale of gas. They keep on trying. If they find they cannot get a consumer one week, they give him a rest, and try him again the next month. The Company evidently echo the Duke's words in "Measure for Measure:"

"Dear Sir, ere long I'll visit you again."

They select their makes of stoves; and at the present time they have six manufacturers on their list, from whom they purchase. I was interested to see the way this and other companies buy their stocks of stoves forward. They do not expect the makers to carry a stock sufficient to supply all the gas companies within two or three days, as companies at home do. They place an order early in the season for a quantity of stoves, which are either delivered right away, or got ready for the companies to their order. I was glad to learn also in Philadelphia of the system of lady inspectors or lady canvassers; it is greatly in favour.

Public and other Lighting. The United Gas Improvement Company also control the Welsbach Incandescent Company of the United States. Under the contract of the former, certain gas lighting required by the city is furnished. Some of the streets are lighted by gas with open flame burners; some by the Welsbach Street Lighting Company of America, who have an exclusive contract with the Welsbach Lighting Company for their apparatus for street lighting only; some by the Pennsylvania Globe Gas-Light Company with gasoline or coal oil products; and some by electricity. There are four electric light companies; and it is understood, while not positively denied, that the city is divided into districts, each one of the electric light companies operating a certain area. It is rather a remarkable coincidence that their bid for public lighting, per lamp per year, is the same to the cent. For certain consumers, dwelling-houses, shops, manufacturing and other indoor lighting, there are about 125,000 meters set, with an average of 5 lights per meter. The Welsbach Lighting Company do a very large business in private residences, stores, shops, &c. Their number of customers in the city, I am informed, is about 300,000. As already stated, the price charged for gas in the city is fixed by ordinance at $1 per 1000 cubic feet; while the street arc lights cost about 23½c. per light per night.

A Friend Old and New. While in Philadelphia, I also had the privilege of greeting Mr. Shelton, whose methods of supplying gas under high pressure to townships at long distances from the manufacturing base has received an acknowledgment on this side, and has created considerable interest. I was also glad to make the acquaintance of the Managing Director of the American Gaslight Company, Mr. George G. Ramsdell. This Company is more interested in the development of coal-gas undertakings than water-gas. These smaller Companies do not approach in magnitude the United Gas Improvement Company; but they have some resemblance to our British Gaslight and Danish Gas Companies.

Mr. A. C. Humphreys and His Work. Of Mr. Humphreys, with whom I had the privilege of frequent intercourse during a portion of my stay in America, I could, did I not fear that he would himself regard it as fulsome, write a great deal. In character, in charm of manner and goodness of heart, in the eminence which he has won in gas engineering, and in the position which he holds in the affections and confidence of the American gas profession, he is the counterpart of two at least of our gas engineering leaders at home. It was with the utmost regret that the United Gas Improvement Company lost his services in 1894; but their loss was the gain of others. His time and his abilities have since then been largely devoted to consultation work; and many undertakings have profited thereby. On his retirement from the position he had held with so much honour, an article appeared in "Light, Heat, and Power" which evidenced the copiousness of the appreciation of Mr. Humphreys in professional circles. Happy must be the man who can attain such a position in the estimation and affections of his personal and business friends!

There can be no objection to my reproducing here of what has already been published in America; and therefore I cannot

refrain from giving the following extract from among much else contained in the paper mentioned:—

The retirement of Mr. A. C. Humphreys from the position in which the gas fraternity has grown into knowledge of him, as engineer and man, needs more than passing notice. It is not the ordinary retirement of a well-known official from active business cares, but rather the laying down of a life-work; for into the ten years which Mr. Humphreys has spent in the service of his Company, he has compressed more hard work and energy than the average engineer would expend in his generation, and the result of this is shown in the system which he leaves behind him, complete with every thread in exact place in the network—a proud masterpiece of executive skill, and the use of brains in management. If Mr. Humphreys' active life were to end to-day, he could be justly proud of the record he has made; but years and paths lie before him, and from the past we are justified in gauging the future. Mr. Humphreys has work before him which will test his abilities, and develop his strength, in lines other than those in which he has so long held leadership.

Then follows a statement as to the development of the Lowe water-gas process from the state of possibilities into that of achievements, which had been wrought through Mr. Humphreys' work. I ask no pardon for quoting also the following passages which appear in a resolution passed by a meeting of superintendents, engineers, and other employees of the United Gas Improvement Company after hearing the announcement of the retirement of their chief. Heartfelt regret was expressed, and then came the words—

A conscientious worker, rarely skilled in his profession, indefatigable, and earnest in purpose—he, more largely than has any one other person, has been the factor that has brought the United Gas Improvement Company to its present enviable position in the gas world to a point wherein its integrity, rank, and purpose is recognized, and where connection with it is an honour to every man of us here assembled. But while we recognize the business ability of Mr. Humphreys, there is yet a deeper and a sweeter attraction that draws us all to him, and that makes the pain of losing him the greater; and that is his integrity, his individuality, his personality, and his magnetism as a man.

Such a panegyric from one's colleagues, in phrase and expression which reveals a deep sincerity, must be gratifying to any man. What was then said of him and what I have quoted, is, I found from personal communion in private life and from mingling with gas men, as true to-day as it was in 1894, and perhaps in even greater measure. Mr. Humphreys was born in Edinburgh on March 30, 1851, and with his family he went to America in the fall of 1859. His entry into the gas profession was made at the age of 21; and eight-and-twenty years later (and before) he is the honoured and recognized leader of the American gas profession. May he long live to hold the position! His career and his place justify this lengthened notice; and I now leave him with Queen Margaret's remark—

"Humphrey is no little man in England."

2 "Henry VI.," Act 3, sc. 1.

(To be continued.)

MR. DIBDIN'S LATEST PRONOUNCEMENT ON THE COMMERCIAL VALUATION OF COAL GAS.

The paper on the "Effect of Quality on the Consumption of Coal Gas," which was read by Mr. W. J. Dibdin before the London Section of the Society of Chemical Industry on the 3rd ult., appears in full in the current issue of the "Journal" published by the Society, together with the discussion thereon, and is therefore available for further notice. There is no special novelty in it, and nothing in the way of an addition to the stock of knowledge on the combustion of gas. The fact that flat-flame burners do not give economical results when consuming twice or three times the nominal rate, is known, not only to gas experts, but to a large section of the public besides. Under the plea of getting a uniform "unit" of light, Mr. Dibdin has simply been reproducing the ignorant practice of fifty years since, and burning gas under abnormally high pressures—a practice which was shown by the Gas Referees some thirty years ago to be prejudicial to gas of any quality, but especially so with low-quality gases. To put the thing in another way, rich gases will stand a certain amount of latitude in the matter of pressure, while more care must be observed in the case of poor gases. But by the ingenious system of adjusting the burner to a fixed "unit" of light, irrespective of quality, consumption per hour, or pressure, Mr. Dibdin secures this important advantage—that the poorer the gas, the greater the pressure at which it is consumed, and therefore the greater the distance from circumstances which secure the best results.

The most prominent feature in the paper is the ingenuity exhibited, not only in finding a new setting for an old saw, but in constructing therefrom an *ex parte* case in support of the author's pronounced views on the subject of the valuation of gas. The law on this point is perfectly clear, as contemplating the establishment of special testing-stations in central positions. But Mr. Dibdin holds very different opinions, as instanced by his introduction of the portable photometer. Bearing this in mind, the paper is an interesting example of the manner in which a professional expert can make the best possible use of facts that are in favour of his own side, and avoid or minimize those that are not. As an example of laboratory practice, it is without exception; and if it had been put forward and accepted as nothing more, there would have been but little to say.

But though listened to and discussed by a society of chemists, the paper was claimed to be a sort of general popular science guide for the instruction of the gas consumer; and although submitted to a body of scientists, there is no special scientific point in it. While the Society of Chemical Industry afforded a convenient platform for its annunciation, the members were only indirectly interested, in their capacity of gas consumers; and it might with the same propriety have been submitted to any average body of gas consumers, would have been discussed with equal intelligence. For one might suppose that the members of the Society of Chemical Industry, by reason of their presumed knowledge of chemistry, would be more familiar with the elementary principles of economical gas consumption than the average consumer of gas, and more capable of applying those principles to their own advantage. But an interesting point incidentally brought out in the course of the discussion is that ignorance and prejudice as regards coal gas are not confined to the non-scientific section of the public. When subjects having a bearing on any point of science connected with gas engineering are brought before the Society of Chemical Industry, a full representation of gas engineering interests is never wanting; but gas engineers can scarcely be expected to discuss purely £ *s. d.* questions.

If Mr. Dibdin would bring forward, say, a new method of determining the proportion of carbonic oxide in gas, he would not have to complain of want of appreciation among the gas engineering fraternity. But when, on the strength of a few laboratory experiments made under impracticable conditions, and the results of which are not free from internecine disagreements, he asks them to discuss whether certain eventualities may or may not have the effect of compelling the consumer to use four times as much gas as at present suffic s for his wants, Mr. Dibdin can scarcely be surprised if they are conspicuous by their absence, and prefer to discuss his conclusions in their own time and in their own way. He is not warranted in the deduction that such absence is a tacit admission that his case is unanswerable. As a laboratory investigation, his latest pronouncement is not the least important of his numerous labours in the cause of photometry, and affords some useful information which the gas consumer may apply to his own advantage. But if it is to be taken as a practical representation of conditions obtaining in the course of ordinary everyday use of gas or that might obtain if a small reduction in the standard should be allowed, then it possesses to the full those peculiar defects to which professional expert evidence is subject, and which tend to render it a matter of contempt in the eyes of the man in the street. The accuracy of the various experiments may be accepted, seeing that it would be difficult to find a more experienced photometrist or skilled experimentalist than Mr. Dibdin, as regards this particular subject. But one must challenge their utility as a means of ascertaining the value of coal gas, or of indicating to the average consumer the extent of service which he receives, or may receive, in return for the cash he hands to the gas collector every quarter.

The London gas-testing arrangements are of a very elaborate and costly character; and yet Mr. Dibdin himself condemns them as inadequate, if not useless. This suggests the question whether the photometrical game is worth the candle. How comes it that, in towns where the gas examiner receives no salary and apportions his labours in accordance with the remuneration (or rather the want of it), gas is as high in popular demand as in places where the gas companies directly, and the consumers indirectly, are mulcted in heavy charges for gas testing? Mr. Dibdin and his followers seem to take it for granted that the gas consumer has no weapon of defence besides the photometer; and that but for their valiant resistance he would soon be swallowed up by the unscrupulous gas monopolist. They overlook the fact that, in practice, gas is by no means such a strong monopoly as it is in a legal sense. Gas companies cannot compel anyone to use gas, but, like other tradesmen, are dependent upon the goodwill of their customers. It might almost be contended that the laws of supply and demand are a sufficient protection. Mr. Dibdin says that if the quality of the London gas was reduced 2 candles, the gas bills would go up 70 per cent. or so, and that the consumer who now pays £4 per quarter would have to pay about £7. If such a thing did occur, the consumer would either largely curtail the use of gas or give it up altogether. The consumer knows about what value in the way of light or heat he receives, and how much hard cash he has to pay for it. If the service is poor and the charges high, he will not be comforted or appeased by a satisfactory photometrical report; and if the supply is good and the charges reasonable, the steep upward curves on Mr. Dibdin's diagrams have no terrors for him, nor will he be in the slightest degree disturbed by the statement that his "equivalent" is in the neighbourhood of 8s. or 9s. per 1000 cubic feet. There are several gas companies in the United Kingdom whose standard is 12 candles; but in actual practice they supply something over 14 candles. As no English gas company supplies a less quality than 14 candles, the experiments on gases below this illuminating power may be at once ruled out of court as superfluous, if not worse.

One is reminded of the pieman referred to in a work of Dickens, who produced "veal and ham," "rabbit," or "pork" out of one common material, and explained that the "seasoning" made the difference. For Mr. Dibdin takes an honest 16-candle gas, and with "seasoning" composed of air, petroleum vapour, or the soluble properties of linseed oil, turns out to order anything

between an 11 and a 19 candle gas. As 11 or 12 candle gas does not exist as a practical commodity, one cannot be very definite about it. But, really, a non-professional reader might form the impression that 14-candle gas as ordinarily supplied is simply a faked 16-candle article, touched up with a seasoning of air or other inexpensive diluent; and so it is necessary to explain that qualities of gas ranging from 14 to 19 candles, as supplied in practice, are manufactured as such in the first place, and not obtained by the simple process of adding air on the one hand or petroleum vapour on the other. A genuine 14 or 19 candle gas, as the case may be, would give results altogether different from Mr. Dibdin's "seasoned" gas; and, as evidenced by Dr. Percy Frankland's experiments (alluded to in the discussion), the "seasoning" will have a great effect on the results obtained.

It would be possible to select towns in which 14, 15, 16, 18, or 20 candle gas is supplied, and to arrange for a series of investigations to be conducted in each place; but this would involve more trouble and expense than could be reasonably expected from one individual author. Yet nothing less can be accepted as of the slightest use in connection with such a wide subject as the laying down of a practical guide to the average consumer as to what actually happens, or may happen, on his own premises. It is too much to ask that any particular quality of gas, low or high, should be condemned on the strength of laboratory experiments, made, for the most part, under impracticable and artificial conditions. There would not be much difficulty in reproducing practical conditions of pressure, &c., in the laboratory; and if the experiments are to be of real use as a guide, it is important that practical limitations should be observed. But a very large number of Mr. Dibdin's experiments could not be repeated on the consumer's premises. It is absolutely untrue that any gas consumer ever has, or under prevailing conditions ever will burn, as much as 12 cubic feet per hour through a No. 4 fishtail burner. Such a burner is constructed to pass 4 cubic feet at about 8-10ths pressure, and to get a consumption of 12 cubic feet, it would be necessary to have a pressure equal to 6 or 7 inches of water. The natural pressure of the gas supply on the average consumer's premises, would be 15-10ths to 25-10ths—say 20-10ths—and he could not get more without resorting to special methods. The probability of his doing this, need not be taken into account. Besides, the consumer will not have a noisy or a flickering light; and at a point somewhere below the maximum pressure in practice, the flame will begin to flicker and roar. So that Mr. Dibdin not only "fakes" the gas, but also the supply pressure.

Gentlemen interested in electric lighting occasionally find it very convenient to ignore the existence of the incandescent gas-burner; and for similar reasons, Mr. Dibdin overlooks the existence of such a thing as a pressure-regulator, either at the meter-inlet or at the burners. Thanks to the labours of the London Gas Referees some thirty years since—labours that benefited the London gas consumer to a much greater extent than will result from the endeavours of Mr. Dibdin and his supporters in the direction of a 19-candle gas—it is much too late in the day to assume that the average consumer has not a fair acquaintance with the effects of excessive pressure and the unfortunate results it may exercise upon the bill. For more than a quarter of a century there has been a brisk trade doing in pressure-regulators, and regulator-burners such as those introduced by Sugg, Peebles, and others. Mr. Dibdin secures another point by attempting to force a 12-candle to do the work of a 16-candle gas. The average consumer knows better, and would not think of trying to get a high "unit" out of a common fishtail or batswing, regardless of the quantity of gas consumed. In actual practice, if a company supplied at a pressure exceeding 3 inches, their district would immediately be invaded by an army of enterprising gentlemen, who would do a roaring trade in pressure-regulators guaranteed to effect economy in the gas bill.

Mr. Dibdin assumes the existence of a gas consumer who wants his light in large parcels, uses none other than the flat-flame burner without regulator, and demands that the quality of the supply shall be regulated to suit these conditions, regardless of financial or similar low-class considerations. If the appliances available for the use of the consumer were confined to the plain iron fishtail or batswing, and if the chief proportion of the gas supplied was of necessity consumed in such appliances, there would be some reason or method in his arguments. But, as a matter of fact, a very small proportion of the whole is used in this manner. Valued according to the quantity consumed, there are other appliances which could claim more consideration than the open or unregulated flat-flame burner. To begin with, a large proportion of the total output is used in atmospheric burners as a source of heat, in cooking-ranges, boiling-burners, stoves, gas-fires, gas-engines, and technical appliances. Something not far short of 50 per cent. of the whole is so disposed of. Then the incandescent lighting burner, in which the gas is really used as a source of heat, is not so small or insignificant an affair as Mr. Dibdin and his friends are inclined to suppose. The sales reported by the Welsbach Company represent a very respectable proportion of the total number of gas-burners in use, and average three or four per consumer throughout the country. Many gas companies who have taken up the agency, and who also undertake maintenance at a moderate rate, can report as much as six burners per consumer. Then there is the large quantity of gas which, though used in flat flames, passes through a pressure-regulator of some form or another, and is thus prevented from being consumed at a rate greatly in excess of the normal capacity of the burner.

After making reasonable allowance for these various classes of consumers, it will be seen that the user of the unregulated flat flame is but a very small proportion of the whole, and certainly not of sufficient importance to be entitled to claim the right to set the time in regard to the quality of the gas supply. In considering the properties of a commodity like gas, which is used for so many different purposes, regard must be had to the requirements of the majority, and not to those of one class only, of which it may be said that it is becoming smaller by degrees and beautifully less. As changes in legislative enactments occupy some time in carrying through, when contemplating anything of this sort regard must be had not only to the present position but to the prospects of the future. If the crude flat-flame community were likely to grow and increase, there would be some reason for urging their interests; but the reverse is the case. The public, and particularly that portion of it who believe in getting as much value as possible in return for their money, are beginning to recognize the fact that the incandescent gas-burner affords by far the cheapest light extant, and is worth a little trouble in the matter of attending to mantles, &c. With mantles on the market at 6d. each, or less, a great extension may be expected; while large sales of cooking and heating stoves continue to prevail. Thus every year witnesses an increase in the demand for a heating gas, and a decrease in its use for lighting by unregulated flat-flame burners.

(To be concluded.)

TECHNICAL RECORD.

THEORY OF THE WATER-GAS PROCESS.

By Drs. H. Strache and R. Jahoda, of Vienna.

[Abstract Translation of Articles published in the "Journal fur Gasbeleuchtung" last year.]

II.—The Run or Make *(Continued)*.

The diagrams below and on p. 276 refer to the trials in which the temperature was directly measured, and show: (1) The average temperature in the generator, (2) the undecomposed steam ex-

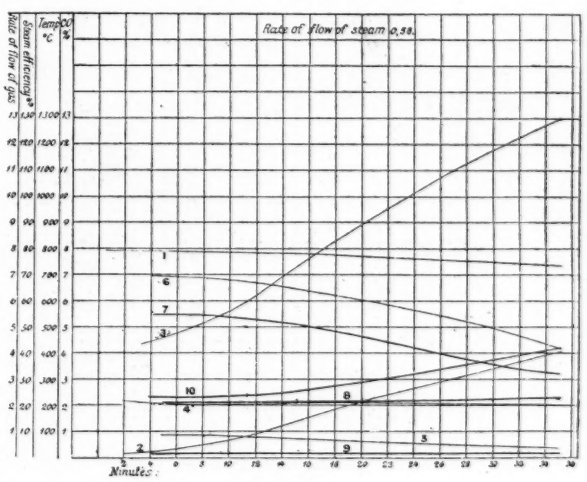


Diagram A.

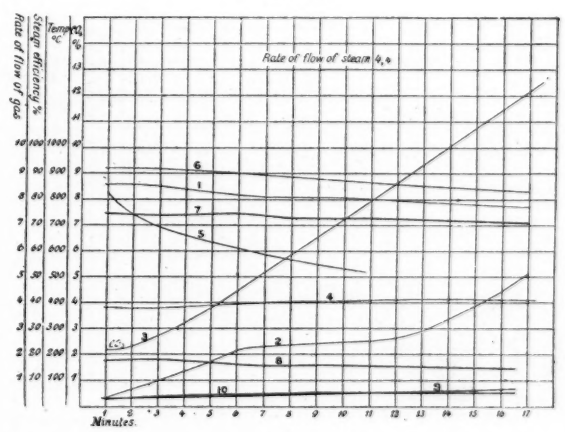


Diagram B.

pressed as a percentage by volume of the effluent mixture of gas and steam, (3) the percentage by volume of carbonic acid in the gas made, (4) the temperature of the effluent mixture of gas and

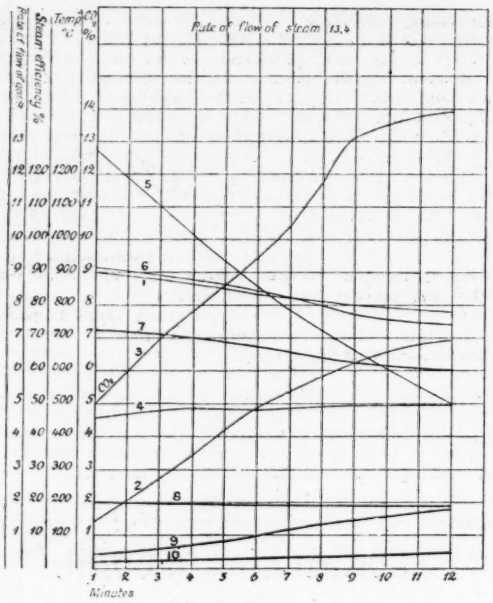


DIAGRAM C.

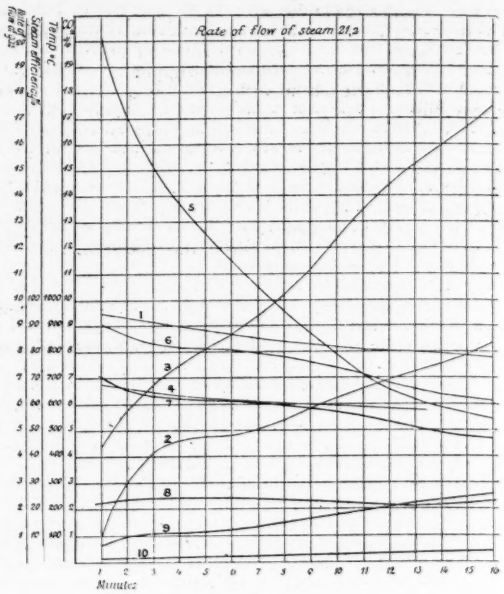


DIAGRAM D.

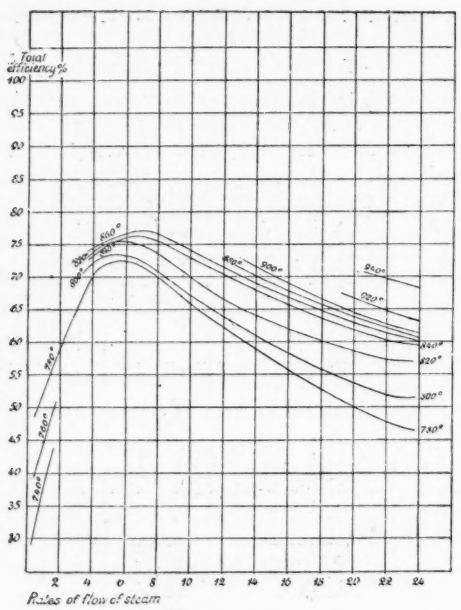


DIAGRAM E.

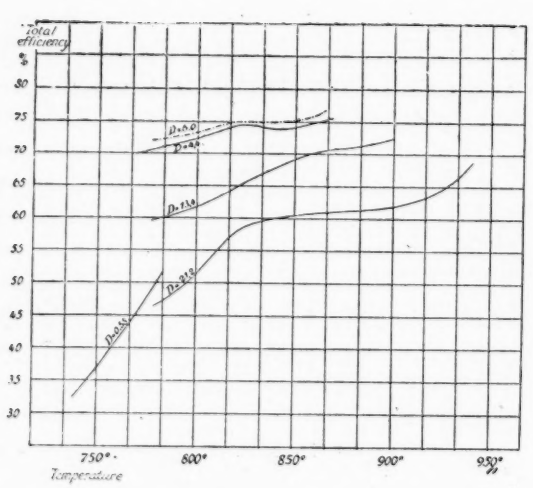


DIAGRAM F.

steam, (5) the rate of flow of the gas, and (6) the efficiency during the runs. The thicker curves show further: (7) The total efficiency, and the other terms of the heat-balance in percentages—viz., (8) the heat of the exit-gases during the blows, (9) the sensible heat of the gas and of the undecomposed steam, and (10) the heat radiated. Each diagram refers to a series of experiments in which the rate of flow of the steam was maintained constant.

The thicker curves indicate clearly what conditions chiefly affect the efficiency. In the first place, it is apparent that the curve which refers to the total efficiency in all cases is approximately parallel to that which refers to the efficiency during the runs, and that the distance of one from the other is nearly the same in every instance. From this, it is evident that, at the temperatures here dealt with, the total efficiency is dependent more on the efficiency during the runs than on the efficiency during the blows.

Reference to particular diagrams further leads to the following observations.

Diagram A, for the very low rate of flow of the steam of 0·58 (1·90 feet) indicates that the drop in efficiency is largely dependent thereon, and that the radiation rises greatly. The very low total efficiency of 55 per cent. is evoked by the high loss by radiation of 22 per cent. But, on the other hand, it is the low make of gas which causes this loss to appear so high. The sensible heat of the gas and of the undecomposed steam is a negligible quantity in this case.

From Diagram B, for the rate of flow of the steam, of 4·4 (14·43 feet), it appears that the loss by radiation has fallen to a minimum, that the sensible heat of the gas and undecomposed steam is still low, and that consequently the efficiency is very good—viz., 71 to 75 per cent.

It appears from Diagram C, for the rate of flow of the steam of 13·4 (43·96 feet), that the sensible heat of the gas and undecomposed steam has risen from 5 to 18 per cent. in consequence of the

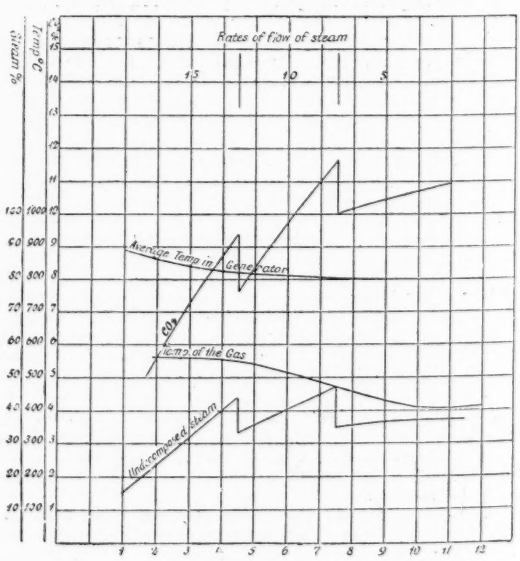


DIAGRAM G.

temperature having fallen considerably, and of the high rate of flow of the steam. The total efficiency has therefore fallen from 72 to 60 per cent.

Diagram D, for the rate of flow of the steam of 21·2 (69·55 feet) shows still more clearly the same effect. Moreover, owing to the high temperature of the generator, the heat carried off by the exit-gases during the flow is higher (carbonic oxide escapes with the exit-gases, on account of the high temperature of the generator); and consequently the efficiency rapidly falls from 70 to 60 per cent., and finally (owing to the large quantity of steam passing through undecomposed) to 47 per cent.

Diagram E shows the total efficiencies at the particular temperatures set out according to the rates of flow of the steam. As in the case of the efficiency for the run only, the maximum efficiency is also at about the rate of flow 6. This maximum is 72·5 per cent. for the temperature of 780° C., and 77 per cent. for 860° C.

Finally, in Diagram F the efficiencies at the particular rates of flow of the steam are set out according to the temperatures. From this, it is again clear that the most favourable efficiency occurs at the rate of flow 6; and for the temperatures now considered, the efficiency rises slightly with the temperature. If, however, the trials had been extended to cover higher temperatures, there is no doubt that a rapid decline in efficiency would have been found, because, as has been shown earlier in this communication, the efficiency of the blow is so low at these high temperatures that the total efficiency would be considerably diminished.

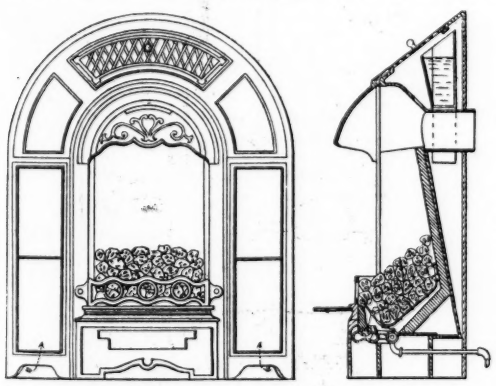
In order to furnish a simple and clear demonstration of the facts that the quantities of steam passing through undecomposed and of carbonic acid formed are dependent on the rate of flow of the steam, one series of trials was made in which, at the beginning of the run, a high rate of flow of the steam—viz., 15—was employed. After four minutes, this rate was reduced to 10, whereupon the amounts of steam and carbonic acid in the gas formed fell, as is apparent from Diagram G. Seven minutes after the commencement of the run, the rate of flow of the steam was reduced again—to 5—and once more a reduction in the amounts of undecomposed steam and of carbonic acid was observed, notwithstanding that the temperature had meanwhile been falling.

(To be continued.)

REGISTER OF PATENTS.

Gas-Fires.—Richmond, E. W. T., Thornton, H. M., and Richmond and Co., Limited, of Stratford. No. 74; Jan. 1, 1900.

This construction of gas-fire consists of the usual type of atmospheric burner placed at the bottom of a well, the sides of which are formed of fire-brick, and slope outwards and upwards from the burner-tips. A stove constructed as shown enables a hot fire to be obtained



with, it is said, a very small consumption of gas. The main air supply to the burners required to complete the combustion of the gas has to pass through the heated fuel in the front of the fire; and it is thereby heated considerably before reaching the gas. The burner, also, is not liable to be caused to fire-back by any sudden draught from the front, as the lower parts of the flames from the burners (being low down in the well) are protected by the fire-brick walls. The flue from the upper part of the stove is preferably made arched; and a water-tank is placed over it, with a removable grid-cover near the top.

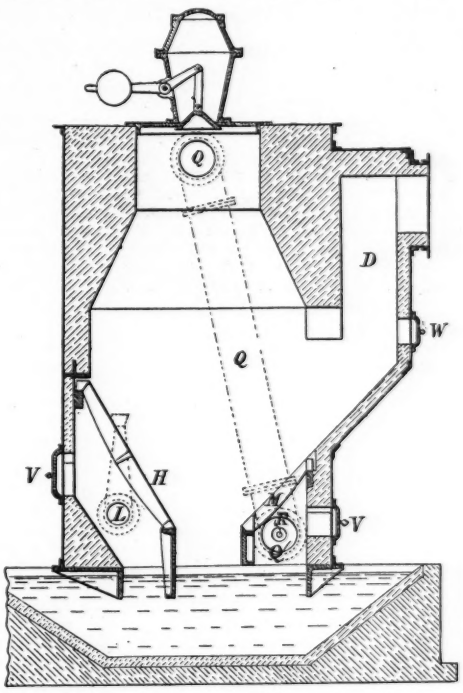
Gas-Producers.—Duff, E. J., of Liverpool. No. 410; Jan. 8, 1900.

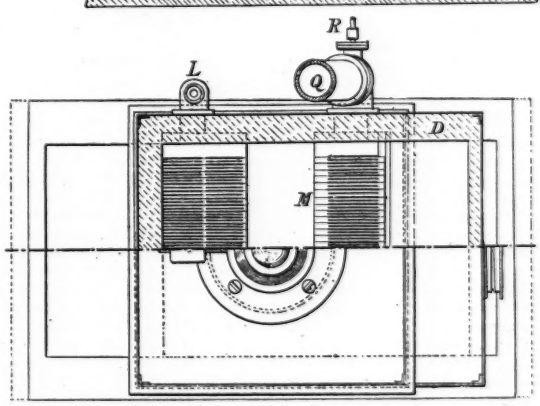
This invention has for its object the making of gas from bituminous coal by a producer so arranged and constructed that the green coal is coked in the upper portion of the fire, and the products of condensable parts of the gas (which contain soot, oils, and tar) are conducted to the lower portions of the fire, and made to traverse the hotter regions of the fuel-bed. In this way, they are converted into fixed incondensable gases, suitable for use in gas-engines and for other purposes, and requiring only a similar amount of cooling and scrubbing as the gases now used for engines when made from anthracite or coke.

The engraving shows a vertical section and a part plan and part section of the producer.*

The upper half of the producer-casing is divided by fire-brick extending right across from side to side, so that a flue D is formed at one side leading to an outlet-flue, near the middle of the top part of that side. The coals are fed in through a hopper on the top of the casing fitted with feeding mechanism of ordinary construction. At one side of the casing inclined gratings H are supported at their upper and lower ends on girders. The air, or air and steam, for combustion or gasification is admitted at one end of the casing by a pipe L, entering the space beneath the gratings H. Passing up through the gratings, it is distributed so as to act uniformly among the coals in the lower half or hotter regions of the fuel-bed. Extending along the opposite side of the casing, similar inclined gratings M are provided, forming a chamber or space separate from that into which the air for supporting combustion is blown. The green coal is coked in the upper portion of the fuel-bed; and the products are led away by a pipe Q, passing from the upper end of the casing down to the space beneath the inclined gratings M, from which space the condensable gases pass up through the gratings, and enter the hotter regions of the fuel-bed.

The gases thus traverse the hotter regions of the fuel-bed without coming in contact with the air supply which supports combustion. By this means, they become fixed and freed from condensable matters without being destroyed by combustion with the air.





To assist in the circulation of the gases, a jet of steam or steam and air is injected through a blower-nozzle R into the lower end of the pipe Q. Between the two sets of gratings H M is a free space, through which the ashes fall freely into an ash-trough, of the width of the space between two of the sides of the structure, but elongated in the other direction so as to extend under, and beyond, the other two sides of the structure. The ends of the trough, where they extend beyond the sides of the structure, have their bottoms sloped upwards; and the ashes or coal residues are raked out at these ends through the water used to seal the bottom of the structure. Some of the ashes will also fall into the trough through the inclined gratings; and should there be any tendency for them to adhere between the gratings, they can be removed by the insertion of a rake through doors V provided for the purpose. There is a similar door W at a higher part of the casing, to permit of examination of the interior.

Moisture rises from the water in the trough to the spaces beneath the gratings, and to the ash-outlet, and tends to cool the gratings and the descending ashes, and thus prevent the destruction of the gratings and the formation of adhering clinker. The position of the gratings also ensures the ashes sliding down their surfaces easily and regularly without tendency to clinker; while "the narrowing space between the gratings corresponds to the diminished bulk of the materials, and promotes the gradual and uniform descent of the whole."

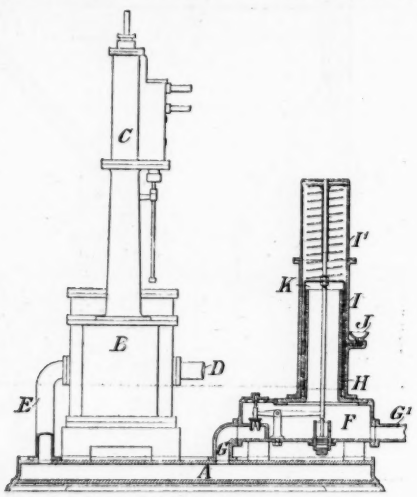
* This is the producer referred to by Mr. Isaac Carr at the meeting of the Institution of Mechanical Engineers on Dec. 14 last (see the following "JOURNAL," p. 1514).

Incandescent Gas Lighting.—Sugg, W. T., of Regency Street, Westminster. No. 2063; Feb. 1, 1900.

In explanation of the object he wished to attain, the patentee says: It has been proved in recent years that the best results from incandescent gas lighting are obtained when the gas is employed under pressure produced by a suitable pump operated by a water or other motor—gas that is drawn from the main at ordinary pressure, and forced into the service-pipes at a pressure of from 9 to 10 inches of water. The speed of the pump is regulated to give the required pressure when the whole installation is at work. Consequently, when lights are turned out, the pressure is likely to increase to such an extent as to materially impair the illuminating power of the remaining lights—as, over a certain pressure, the result is not so good. To obviate this difficulty, regulating mechanism has been adapted to operate the cock or valve of the motor fluid supply to the motor when the pressure of the gas has exceeded a given limit, so as to cut off the supply of the motor fluid, and thus slow-down the speed of the motor, stop it altogether, or increase it, as the case may be. But a further objection here arises—viz., in the wire-drawing of the motor fluid so that the motor does not at once answer to the demands made upon it; and furthermore, there is no reserve of gas maintained—the result being that the pressure, and consequently the light, fluctuates, giving rise to the "bobbing" more or less of the gas.

The present invention is designed to overcome these objections, by ensuring at all times a full supply of fluid for the motor, so that it will at once commence to work when required, and by maintaining a reserve of gas sufficient to supply the full pressure required while the pump is (so to speak) getting to work. A device for cutting off the supply of motor fluid is unnecessary—any excess of pressure produced, itself effecting the slowing-down or stopping of the motor.

The illustration shows (in elevation, partly in section) the general arrangement of the apparatus employed. A is a gas-tight reservoir. B is a pump or pressure increaser, operated direct by a water-motor C (both of any convenient construction). The inlet to the pump is connected by the pipe D to the gas-main or supply; and the outlet communicates, by the pipe E, with the reservoir A. F represents the regulating mechanism, connected with the reservoir by the pipe G, and



with the installation by the pipe G^1. This mechanism consists of a chamber having at the inlet-end a partition pierced to receive a valve, the operation of which will be presently explained. On the top of the chamber, and open to it, is arranged a cylinder H, which is contained within a second and concentric cylinder I, so as to leave an annular space between the two cylinders to receive some sealing fluid. The outer cylinder is provided with a funnel and port J, by which the fluid can be run into the annular space when the apparatus is installed. In the annular space is placed a bell K of a depth equal to that of the cylinder H, and serving to close the outlet of the cylinder. The bell is provided with a rod or stem extending above and below, and serving partly as a guide-rod and partly to operate a lever with which it is suitably connected, and which carries and operates the inlet-valve in the partition before mentioned. The cylinder I is provided with a prolongation I^1, having a cover carrying internally a tubular guide to receive a guide-rod. This tubular guide is open at top to the atmosphere, and is threaded externally to receive a disc or head, which will serve as a top abutment for a regulating spring, the tension of which is set by screwing up or down the disc or head on the guide. The spring bears at the other end on the top of the bell K, the movement of which is thus regulated. At the lower end, the stem is connected to a piston working in a dashpot secured at the bottom of the chamber F. The valve is provided, on its underside, with a cylindrical extension which fits the opening of the partition; and across the cylinder is formed a taper or triangular notch, so that, as the valve rises and falls, the passage for the gas will be more or less increased or diminished.

The working of the apparatus is as follows: Suppose the outlet G^1 to the installation is reduced (say) by turning out lights, it will be obvious that the gas being pumped into the chamber F will not be able to get away at the same speed as it is entering, or not at all; and consequently the pressure of the gas in the chamber will increase beyond the normal for which the apparatus is set. The moveable part of the apparatus—that is to say, the bell K—will thus be caused to rise, and operate the valve, which will more or less close (or entirely close, as the case may be) the opening in the partition which forms the inlet to the chamber F. Thus the quantity of gas allowed to pass the valve will depend upon the requirements at the outlet G^1. Suppose, now, the outlet is entirely closed, the valve will also be entirely closed. But the pump will continue to work until the resistance of the compressed gas in the reservoir A is greater than the hydraulic pressure; and the pump will be automatically stopped. Directly the pressure is relieved at the outlet of the chamber F (by lighting up), the bell K will drop, and open the valve; and the pressure in the reservoir A will also be relieved. As the resistance to the hydraulic pressure will thus be removed, the pump commences to work at once; the full head of water to the motor being retained open, and ready to operate the motor. At the same time, the excess of pressure of the gas in the reservoir will be sufficient to keep up the requisite pressure on the installation until the pump is fully at work.

Hot-Coke Conveyors.—Graham, M., of Leeds. No. 11,979; July 3, 1900.

This invention relates to hot-coke conveyors as described in patent

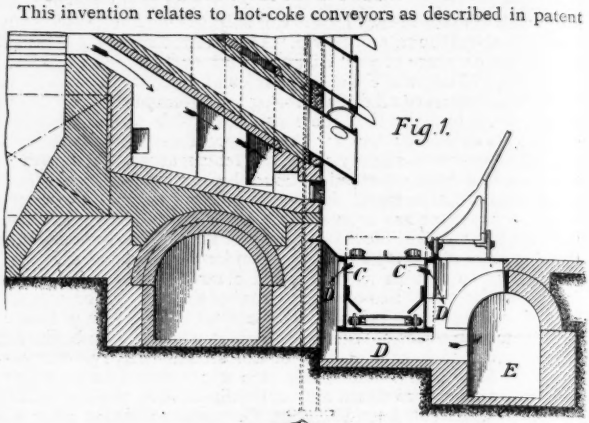


Fig. 1.

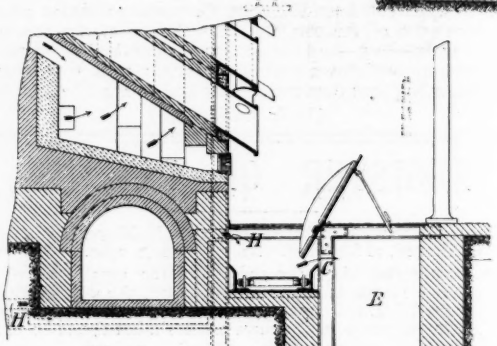
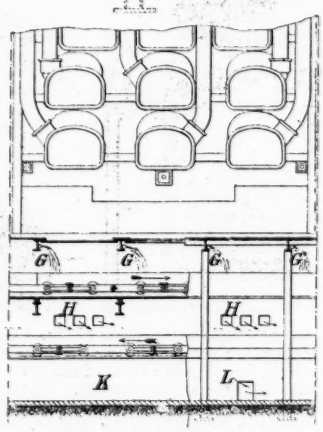


Fig. 2



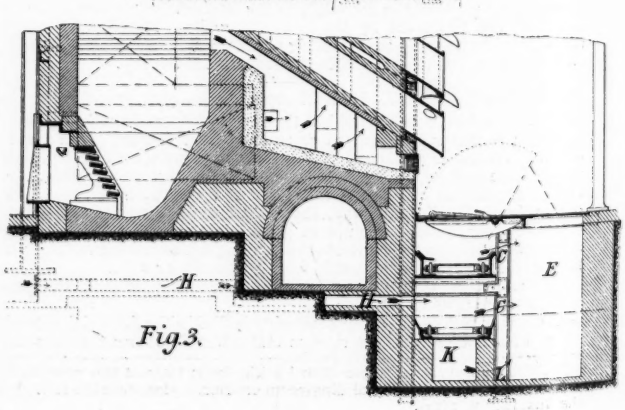


Fig. 3.

No. 24,659 of 1899; the object being to extract from the coke-conveyor trough (by means of exhaustion or pressure) the steam, fumes, and smoke produced by the hot coke within the trough, and also to dry the coke within the trough after quenching.

For this purpose, the main flue leading to the chimney is connected to the coke-conveyor trough by a series of pipes or flues, suitably arranged; and regulated drying-inlets are provided in the conveyor trough, for the admission of flames, hot air, or waste gases, either from the setting, from a separate furnace, or from any other convenient source.

Fig. 1 is a cross section of part of a coke-conveying plant, illustrating one method of extracting steam and fumes from the conveying trough. Fig. 2 shows a method of extracting steam and fumes from the trough, with an additional arrangement for drying the coke within the trough during the forward travel of the conveyor. Fig. 3 presents a method of doing so during both the forward and the return travel of the conveyor, a cross section, and a front elevation (partly in section).

C are the discharge openings or outlets, arranged at short intervals each side of the trough (fig. 1), and connected by branch flues D to the main flue E; or the discharge-outlet C may be direct into the main flue E over one side of the trough (figs. 2 and 3). Or, in lieu of these branch flues, pipes may discharge into the main flue, or into any suitably placed shaft or chimney. A blower, exhauster, or fan, connected to the coke-conveyor trough, may also be employed. By this means, the steam and fumes are drawn or forced either into the main flue E or into the shaft or chimney. Sprinkler pipes G (fig. 3) may also be provided to quench the hot coke within the conveyor trough.

The additional drying arrangement consists of inlet flues or pipes H (figs. 2 and 3), allowing hot air, flames, or waste gases to be admitted in regulated quantities from any convenient source, and circulated over the coke within the trough (or circulated below the trough), and discharged by the openings C into the flue E or into the shaft or chimney. An extra drying-flue K (fig. 3), connecting preferably with a separate furnace and discharging at L into the flue E, may also be provided

APPLICATIONS FOR LETTERS PATENT.

357.—URQUHART, R. J., "Acetylene lamps." A communication from O. F. Kubin. Jan. 7.
358.—SIMMANCE, J. F., and ABADY, J., "Street lanterns." Jan. 7.
398.—WOODWARD, J., "Storing and loading coke, coal, and other materials." Jan. 7.
405.—DAUBENSPECK, G., and SMITH, O. H., "Refractory incandescent mantles." Jan. 7.
406.—SOBBE, F. A. VON, "Street and other lamps." Jan. 7.
415.—AGERON, J. A., BAUMES, C. E., and DELCOURT, E., "A new kind of gas for illuminating, heating, or motive purposes." Jan. 7.
425.—BEST, R. H., and STEVENTON, T., "Cocks for gas-lamps." Jan. 7.
439.—JIROTKA, B. V., and ROTH, J., "Acetylene lamps." Jan. 8.
463.—MAWSON, E. O., and MIRZA, A. T., "Gas and oil engines." Jan. 8.
478.—KAUTNY, T., and LOTZ, R. W., "Acetylene gas generators." Jan. 8.
524.—WOODALL, J. W., and WINDHAM, F., "Improvements in, or relating to, carbide of calcium." Jan. 8.
540.—WHITEHEAD, J. W., "Gas-burners." Jan. 9.
571.—CLAMOND, C., "Incandescence mantles." Jan. 9.
572.—CALKINS, J. H., "Generating acetylene gas." Jan. 9.
581.—NAPIER, M. S., and EDGE, S. F., "Carburettors." Jan. 9.
612.—KENNEDY, R., "Manufacture of sulphate of ammonia from furnace gases." Jan. 10.
645.—BEESE, R., "Self-igniting attachment for gas-burners." Jan. 10.
646.—BEESE, R., "Regulator for gas-burners." Jan. 10.
654.—INGRAM, S. J., "Charging gas-retorts." Jan. 10.
697.—RADCLIFFE, J., "Manufacture of gas." Jan. 10.
747.—HAYMAN, A. F. P., "Stopperfor inclined gas-retorts." Jan. 11.
763.—HOOKER, W., "Incandescent gas-burners." Jan. 11.
781.—NAEF, P., "Production of gas in gas producers, and its treatment and utilization in internal combustion engines." Jan. 11.
783.—HUNTER, J., "Bunsen burners." Jan. 12.
784.—M'CURD, W. A., "Internal combustion engines." Jan. 12,
794.—HOLMES, H., and LAMBERT, J. W., "Anti-vibrators for incandescent gas-burners." Jan. 12.
795.—SOUTHALL, J., "Internal combustion engines." Jan. 12.
798.—SHERBURN, W. H., "Bunsen burners." Jan. 12.
803.—WARWICK, R., "Incandescent gas and other lamps." Jan 12.
826.—FORBES, D. W., "Carburettor." Jan. 12,
827.—KOHL, G., "Incandescent bodies." Jan. 12.
882.—PLESTER, J. W., and PARKER, W. H. B., "Cooking-ovens for oil and gas stoves." Jan. 14.
902.—COTSWORTH, G. G., "Water-meters." Jan. 14.
906.—SEFTON-JONES, H., "Automatic gas-lighting apparatus operated by gas pressure." A communication from C. Fader. Jan. 14.
919.—PYE, T. E., "Production and storage of acetylene gas." Jan. 14.
921.—SCHROTZ, C., "Preventing fluctuation of gas-flames supplied from gas-engine mains." Jan. 14.
961.—WILSON, W., "Tap for street gas-lamps." Jan. 15.
974.—KAY, N. S., "Shades employed in connection with electric and gas lights." Jan. 15.
978.—BURGER, L. F., "Gas-engines." Jan. 15.
993.—SCHNIEWIND, F. W. C., "Regenerative coke-ovens." Jan. 15.
1001.—NEUREUTHER, C. F., "Regenerative retort-heating furnace." Jan. 15.
1018.—LEWIS, J., "Ignition of incandescent gas-lights." Jan. 15.
1022.—THWAITE, B. H., "Producing combustible gas." Jan. 16.
1058.—SHELDRAKE, J. H., "Incandescence gas-burners." Jan. 16.
1067.—GIBBS, G. M., "Automatic gas-cock." Jan. 16.
1096.—WEBB, J. E., "Lamp-heads for the extraction and destruction of sewer gas." Jan. 16.
1123.—ROWBOTHAM, W. & K. A., "Heat-engines." Jan. 17.
1173.—HARTRIDGE, J. H., "Enriching gas." Jan. 18.
1242.—SIMMANCE, J. F., and ABADY, J., "Photometer." Jan. 18.
1283.—MARTIN, M., "Generating acetylene gas." Jan. 19.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Retort Ascension-Pipes.

SIR,—In your issue of Dec. 18, you published a letter from me upon the above subject. Three or four communications subsequently appeared from different correspondents upon the same matter; and in addition to these, several letters have been addressed direct to me. Perhaps you will allow me to make a few remarks upon the correspondence generally.

In the "JOURNAL" for Dec. 25, a letter appeared from Mr. Simmonds, who kindly recorded therein for the benefit of your readers the actual experiences he had obtained with only one ascension-pipe. These may be summarized as follows: 1. The reduction in the temperature of the gas entering the hydraulic main. 2. The certainty of knowing which way the gas is travelling. 3. The minimizing of the stopped-pipe nuisance. 4. The saving in construction. 5. The reduction by one-half of the number of pipes to be kept clear. 6. The improvement obtainable where stoking machinery is used. All the points enumerated are most important ones; and they cannot fail to be of considerable interest and value. In some works it is the practice to allot a certain number of ascension-pipes per "pipe cleaner." Hence, the halving of the number of pipes to be cleared is a manifest saving.

An anonymous correspondent in the same number of the "JOURNAL," under the *nom-de-plume* of "Merle Blanc," has also supplied me at all events with the information that one ascension-pipe to through retorts was tried many years ago at the Nine Elms works, by the late respected Mr. John Methven. Singularly enough, several authorities to whom I have named the matter had not before heard of it.

It will not be overlooked that, over and over again, the claim of the great economy effected by inclined retorts in this matter of single ascension-pipes over horizontal ones, has been urged. It now appears that such a claim must be abandoned.

One is rather amused by "Merle Blanc," who suggestively remarks as follows: "The reasoning and facts are no doubt quite correct, but were, however, fully known to the generality of gas engineers—particularly to those who have had experience with inclined retorts and stoking machinery with 20-feet through retorts." It may interest this gentleman to know that all the coal carbonized at these works for several years has been with inclined retorts, and that previously to my accepting the appointment here I had under my charge one of the finest installations of compressed-air stoking machinery extant, at the Birmingham Gas-Works.

In the "JOURNAL" for Jan. 1, Mr. S. Carpenter also supplies some further information upon the matter. This gentleman distinctly affirms that there is no need for two ascension-pipes in any case. These remarks are supplemented by a statement that, where there are two ascension-pipes, it is necessary for both to be stopped before any obstruction is discernible in either. His practical experience upon the matter bears exactly upon the whole subject.

Many engineers who have to deal with through retorts know that, even when the two pipes have been known to be stopped, it has only been possible to clear one on account of want of time. Truly it would be a revelation to know the exact state of all the ascension-pipes in a retort-bench where two pipes are in vogue.

The lengthened experience of 46 years (such as Mr. S. Carpenter is kind enough to give) may be safely taken as a confirmation of my suggestion that it was open to question whether the stopped-pipe trouble was not indeed actually augmented by the double system of pipes. Indeed, the fact that he has shut off one of the hydraulic mains and used only one of them for years (which worked satisfactorily), is a sufficient proof, coupled with his further statement that "the number of stopped pipes was not worth noticing;" while the further benefit that the hydraulic main was kept free from thick tar is also apparent. Many of us know what summer cleaning out of hydraulic mains involves.

In some of the letters before mentioned different views and opinions are expressed. One writer says that if only one ascension-pipe is used, then the single one must be of double the area, so as to be equivalent to the two pipes. To a certain extent this may be correct—that is, supposing for a moment the gas travels in an equal stream up each ascension-pipe. It has, however, been clearly demonstrated that such is not the case. Scores of times I have noticed the ascension-pipes, as previously stated in my former letter, warm on one side, and cold on the opposite one, from which the course of the gas can be ascertained without any extensive experiments.

Further than this, upon trying the ascension-pipes with augers, I have found some completely blocked up, although, apart from the temperature, no sign of a stoppage was apparent before trial, as the pipe at the opposite end was quite clear.

In my opinion, arch, dip, and ascension pipes are often stopped on one side of the bench in many works, and the one pipe is doing the whole of the work, and this more satisfactorily than when both pipes are working—the gas being compelled to pass uniformly up the one pipe.

A careful investigation of an installation of through retorts reveals a good deal in this direction. For instance, what have been technically called "rat holes" have been poked through a portion of a blockage in the ascension-pipes. This pipe, so long as it passes a small quantity of gas through the arch-pipes at the top, has been termed clear, or at all events has been allowed to pass muster. The area of such a small passage is very insignificant. In many instances it has only been of sufficient size to allow the smoke to issue through the arch-pipe at the top with the cap removed.

Another writer suggests that a naked mouthpiece, without any ascension-pipe, would look very odd. Personally, I do not see the slightest point in this argument.

Another writer suggests that one-half of the retort ascension-pipes should be put on one side of the bench, and the remainder on the other. Such an arrangement permits of plenty of space being available for the ascension-pipes; but it possesses the primary disadvantage of requiring duplicate hydraulic and foul mains, tar and liquor pipes, &c.

After careful consideration of the whole matter, I am fully convinced

that only one ascension-pipe is necessary for through retorts, although it is the universal practice to have two.

Huddersfield, Jan. 23, 1901. EDWARD A. HARMAN.

Gas-Fires.

SIR,—I must ask your permission to correct some statements with regard to myself. I am not, in any sense, and never have been, a "manufacturer of trade goods;" nor do I "imagine that the term artistic is synonymous with costly or beautifully finished." My work is purely technical; and I have had nothing to do with the designs of any articles for sale for the last thirteen years at least. My artistic fancies and possessions include work which has had a prominent position in the Royal Academy. I am supposed to be a fairly good carver in ivory; and, although I have been commissioned to collect for several foreign museums, and own some unique specimens of metal work, they are not "beautifully finished," although they may in some cases be "costly" and unique. I simply stated the facts of the case.

A "handful of chips and three bricks" may be artistic, but they will not warm a room in this climate; nor will a fire of good oak-logs on the hearth, with the ends resting on a pair of old Flemish fire-dogs—as we have proved. Art alone is not enough.

The simple fact is that really good designs, well adapted for their purpose, will not sell, much to my own personal disgust; and any attempt to popularize these would mean bankruptcy. Those who are not intimately acquainted with this class of work can form no idea of its cost. I had the superintendence of a design, worked out by a well-known artist, for a fire for his own studio. This cost about £200 before a single casting was made; and the total sales in twelve months did not cover one-quarter of the costs out of pocket. The same result occurred with one designed specially for the Paris Exhibition. Both were greatly admired; but neither repaid the cost of production.

In this country, as in many others, the true artist is often nearer starvation than the itinerant vendor of cats' meat. THOS. FLETCHER.

Warrington, Jan. 24, 1901.

SIR,—I have read Mr. Fletcher's letter in the last number of the "JOURNAL," and your own remarks thereon, with much interest, for, though sanguine as to the future of heating by gas, I feel that it is yet in its infancy. Mr. Fletcher maintains that "all houses, without exception, are fitted with coal-fire grates," and that "the fashion and the universal desire is to have something which 'looks' warm." Well, Sir, accepting these postulates, as we readily may, I think the coal-fire grate may still be used for such a modest consumption of coal or wood as may be necessary for appearances only, while the gas-fire is employed out of sight for warming purposes. Very many country houses nowadays are warmed with hot-water pipes, though the log crackles cheerily on the hearth; but, unfortunately, such warming is much at the mercy of the man in the stokehole. Why, then, should not a like system be more universally applied to London houses, where the use of gas would offer an easy control of temperature in accordance with the vagaries of the thermometer? U. J. BURKE.

Petersfield, Jan. 25, 1901.

Gas Heating and Cooking: Past, Present, and Future.

SIR,—The important questions raised in your essay of the 1st inst., on the New Year, call for serious consideration by all who know the advantages, and believe in the future of gas heating and cooking.

It was most fitting that Mr. Thomas Fletcher—whose study, experiments, and experiences of the last 15 years give special weight to his opinions—should be the first to accept your suggestion to discuss the present position of this interesting problem. Being deeply interested in this question—having had the honour of association with Mr. Fletcher and his co-workers in the study and production of gas heating and cooking appliances during the greater part of that time—you will, I am sure, permit me to say that, while I fully endorse the main points of your New Year's essay, as well as the remarks of Mr. Fletcher, I am surprised to find you both (for the moment only, I hope) on the pessimistic side on such a question.

That the average gas-fire is a sham—often a miserable one—few will deny. And that by reason of this, and other defects (notably lighting-back), coupled with the mischievous and dangerous assertions of unscrupulous dealers, that no flue is necessary, &c., great prejudice has been raised against them, is also a fact. These prejudices, and the causes of them, real and serious as they are, are not unsurmountable, however; and although they will not be immediately dispelled, they will gradually disappear on the introduction of more honest and reliable appliances produced and fixed in a manner more in harmony with present needs.

That it is easier, and more immediately lucrative, to give the public a sham, is often true; but it is also true that the sham will not permanently satisfy, and that the public may be educated to take what is best, even in spite of prejudice, if it is proved to be good.

Mr. Fletcher has often proved this in the introduction of new appliances. How often has he given his customers better tools than asked for, and for which he has afterwards been thanked?

No! No! Mr. Editor and Mr. Fletcher! Optimism for the New Century, please.

There is still a future, and a bright one, for domestic gas heating; and although the charm of a living coal-fire—despite its waste and dirt—has a powerful hold on British sentiment, there is a large and rapidly increasing public on the look-out for the right thing. Though it has not yet made its appearance, it will surely do so in response to systematic, patient, and wise labour on the part of those who determine to follow the footsteps of such pioneers as Mr. Fletcher.

We cannot but deplore the lack of originality displayed in the great mass of mediocrity at too many exhibitions. If half the labour expended on slavish copying had been devoted to original research, our position might have been far more creditable. The subject is so large, and has so many sides, that its complete discussion would perhaps occupy too much space, although I do not know a subject of more importance to the gas industry at the present time.

If gas manufacturers—companies and corporations alike—were fully alive to their own best interests, and the possibilities of development in this direction, they would give greater encouragement to the production of more perfect appliances; knowing that in this direction lies the greatest promise of future increase of business.

How strange and anomalous it seems to find that, with few exceptions, the manufacturers of gas apparatus have been saddled with the work and expense of holding exhibitions and educating the public in the use of gas—their own interest being the sale of the cooker, fire, or burner; while those who have the permanent interest in the constant sale of their production, stand calmly by and do little. When gas producers realize their possibilities and duty, the advance—both in quality and quantity of the appliances used—will be more rapid.

In the meantime, it would be well to note the rate of advance which the sister science of electricity is making in all directions, and take the hint—or!!—pessimism. W. H. SHERBURN.

Falkirk, Jan. 25, 1901.

"Ammonia" writes: Can you or any of your correspondents inform me what is the average yield of sulphate of ammonia per ton of coal carbonized in gas-works in England and Scotland; also what is the usual strength of liquor?

LEGAL INTELLIGENCE.

RAILWAY AND CANAL COMMISSION.—Tuesday, Jan. 22.

(*Before Mr. Justice* WRIGHT, *the Right Hon. Sir* F. PEEL, *and the Right Hon. Viscount* COBHAM.)

Vestry of St. Mary, Battersea, v. Southwark and Vauxhall Water Company and Lambeth Water-Works Company.

This was an application which had been lodged by the Vestry of St. Mary, Battersea, against the above-named Companies in reference to their supply of water for domestic purposes. The case of the Southwark and Vauxhall Company was taken first, and the allegation of the applicants was that on certain occasions water unfit for domestic consumption had been supplied. On the formation of the Metropolitan Borough of Battersea, the application was taken over by the Council; no objection being offered by the Companies. The case turned largely on the analyses made of the water on behalf of both parties.

Mr. CRIPPS, Mr. J. E. EARLE, and Mr. COURTHOPE MUNRO represented the applicants; Mr. CLAUDE BAGGALLAY and Mr. H. S. SUTTON appeared for the Southwark and Vauxhall Water Company; and Mr. PEMBER and Mr. SUTTON for the Lambeth Water Company.

Mr. CRIPPS, in opening the case, said this was the first application to be tried under the Act passed in 1897 giving this Court special power to deal with complaints made by local authorities against the quantity or quality of water supplied within the districts of the various London Water Companies. The complaint was framed on section 1; but substantially it was under sub-section 2, which was to the effect that if at any time complaint was made to the Railway and Canal Commissioners, by any water consumer or local authority, as to the quantity or quality of the water supplied, the Commissioners might hear and determine such complaint: and, if satisfied that it was well founded, might order the Company within a reasonable time, to be specified, to remedy the matters complained of, and to enforce the order in a similar manner to other orders of the Commissioners, and also to award damages to the complainants. The general nature of the first case was this: On certain specified occasions, water had been supplied by the Southwark and Vauxhall Company in the Battersea district which, according to the opinion of the expert advising the Local Authority, was unfit for domestic consumption. The second case was of the same character; but it would be convenient to take them separately, as, of course, there might be a good case against one and not against the other. He would therefore take the Southwark and Vauxhall first, especially as a far larger portion of the district concerned was within the supply of that Company than in that of the Lambeth Company. [Counsel handed up a map coloured to show the portion of the district served by the two Companies.] The remedy which appeared to be the proper one was that some order should be made requiring sufficient storage and filtration of the Thames water, so as to render it fit for domestic purposes and consumption. The parties were not there to discuss the large question whether Thames water was or was not proper for the supply of the Metropolis; and so, for the present purpose, he would assume that it was. But they said that the water supply had been of bad quality. This was a scientific matter which would chiefly depend on the evidence of experts who analyzed the water, and who would give their opinions on the analyses made by Mr. Cassal.

Justice WRIGHT asked if there were any Act other than that of 1897 which defined the duty of the Company as to the quality of water to be supplied.

Mr. CRIPPS said section 4 of the Metropolis Water Act, 1852, provided that every Company should effectually filter all water supplied by them within the Metropolis for domestic use before it passed into the pipes for distribution.

Mr. BAGGALLAY said section 35 of the Water-Works Clauses Act, 1847, required the Companies to provide pure and wholesome water; but that section was excluded from incorporation in the Southwark and Vauxhall Company's Act.

Mr. CRIPPS said this was so; but their Act of 1852 had in section 4 provided practically the same thing. Since June, 1892, the applicants had caused samples of the water supplied by the defendants to be taken from time to time at regular intervals, and had submitted them for analysis; and a list of samples was given in the particulars on which they specially relied, running from June 12, 1892, to Nov. 20, 1899. In each of the above cases, notice was given to the defendants and complaint made. They also furnished particulars of other cases where the water was shown to be of inferior character, but not so bad

as those to which he had just referred. In answer, there were three points taken by the defendants. In the first place, they denied altogether that they had been in any way remiss in their duties; secondly, they said the samples were taken under conditions which were not fair, and which did not really show the state of the water when delivered for the purposes of consumption; and, lastly, they raised a point under the Public Authorities Protection Act, 1893. Further particulars had been asked for, as to the reasons for which the water was condemned; and these had been given, and would appear in the evidence. Stated generally, they referred to the colour and turbidity of the water, and to the presence of objectionable matter. The answer of the Company was shortly this: That they had taken samples which had been analyzed by Professor Dewar, Sir William Crookes, and the late Sir Edward Frankland, and these showed that the water supplied was of good quality for the purpose of domestic consumption. The question would be: How was this difference of opinion to be explained? There was one broad ground on which the complainants took exception to the Company's analyses—viz., that, as he was instructed, their samples were not taken at the point of supply, but at the point where the water left the filter-beds; and, in the view of their experts, in the case of Thames water (which was not absolutely pure) it ought to be tested at the point of consumption, because it might deteriorate after it left the filter-beds.

Mr. BAGGALLAY said it would be found that samples had been taken not only at the filter-beds, but also from the mains and other parts of the system.

Mr. CRIPPS (continuing) said another point to which he was going to refer was that the analyses of the advisers of the Water Companies were given in an average form. One did not get the result of any particular analysis, but a summary extending over a period of a month; and this did not give a true criterion of the quality of the water supplied on any particular occasion.

Mr. BAGGALLAY said his friend was again mistaken. It was true that averages were given; but the details were given also.

Mr. CRIPPS said he was told that the reports of Professor Dewar and Sir William Crookes were founded on the averages. Apart from these differences, however, he knew of no other explanation of the different results which had been obtained by the Companies' analysts and those obtained by the public analyst employed by the Vestry. Of course, the complainants must substantiate their case; but if it were shown that samples fairly taken were ascertained to be unsatisfactory, it was no answer that other samples were obtained showing better results. As he understood, there was not much difference in the chemical analyses; but, in addition, the Companies had given the results of the bacteriological examination of the water. He gathered that these returns were not in themselves unsatisfactory. But his contention was that the bacteriological method, as carried out at present, was unsatisfactory, because all that was ascertained was the number of bacteria, whereas, as he was informed, it was the character of the bacteria on which everything depended. There might be a large number of innocent organisms, or a small number of bacteria of a very detrimental character; and he should produce statistics to show that at the time the analyses of the Companies were less satisfactory in this respect, there was an increase of illness in the district. They were not there to condemn the Thames as a source of supply; but, so far as it went, to approve of it. The water must, however, be sufficiently filtered, so as not to become dangerous to health.

The following witnesses were then called.

Mr. *Isaac Young*, Chief Sanitary Inspector for Battersea, said samples of water had been taken periodically since 1890 under his direction—formerly every three months, but latterly monthly. He first took a sample personally in June, 1892; and he gave particulars of several others which he had taken.

Cross-examined: Since June, 1892, some 45 samples had been taken. Nine of these had been complained of as unfit for use, and four more had been mentioned as being very inferior. The monthly examinations commenced about two years ago, soon after it was resolved by the Vestry to initiate a crusade against the Water Companies with the view of the water supply being vested in the people of London.

Justice WRIGHT suggested that it was not worth while taking up time about matters so far back as 1892; and, after some discussion, it was ultimately decided to practically confine the investigation to what had happened since 1896.

Several witnesses having deposed to taking samples of water and sealing them up for analysis,

Mr. *C. E. Cassal*, the Public Analyst of Kensington and other places, was called, and said he had for several years past made a speciality of water analysis, and had acted for the Vestry of Battersea since 1889. From time to time he had directed the attention of the authorities to the water supplied by the Southwark and Vauxhall Company. On the 31st of March he received a sample, which he at once analyzed. He condemned it as being not equal to what Thames-derived water should be when in fair condition. It was tolerably clear, but with a strongly-marked yellowish colour when examined in a two-foot tube, and was objectionable on that ground alone. Thames-derived water should not, in any possible condition, have a strongly-marked yellow colour. The analysis showed organic or albuminoid ammonia 0·168; and he condemned it on this ground also, as indicating the presence of nitrogenous organic polluting matters in much too high a quantity. Thames water in fair condition should yield about 0·075 to 0·08 part of albuminoid ammonia per million. The oxygen absorbed in four hours was 1·945 parts. A fair figure for this was about 0·6 to 0·7 part per million. He also submitted this sample to microscopic examination, and found broken-down vegetable matter in some quantity and a certain amount of mineral matter, which was of no importance. He condemned the water as unfit for drinking purposes, and reported accordingly. On June 26, 1896, he received another sample, which he also condemned. On Sept. 30, 1896, he received a sample which was taken on the 28th. The organic matter in it and the oxygen absorbed were much too high. Microscopic examination showed flocculent organic matter of a vegetable character. In his opinion, the water had been insufficiently purified. On the 6th of January, he received a sample which was fairly clear and showed 0·136 part of albuminoid ammonia per million, which was a high figure; and he reported it as inferior, but did not condemn it altogether. On the 12th of March he analyzed another sample (taken on the 11th), which he reported as approaching inferiority on the ground that it contained organic ammonia, and that the water was slightly cloudy and had too deep a colour. On Dec. 23, 1898, he examined a sample taken the previous day, which he reported as having been insufficiently purified, and very inferior. The organic ammonia was 0·132 part, and the oxygen absorbed 1·973 parts, which was very high. The important point there was that the chlorine was higher than usual. The normal standard for chlorine was 1·8 parts per million.

Justice WRIGHT asked the witness if he attached much importance to the nitrates, because the sample taken in December, 1898, appeared to contain a larger percentage than any other.

Witness said the nitrates were decidedly high; but the conclusions to be drawn from that figure were not very important in London waters, as a rule. They sometimes indicated insufficient purification. He attached most importance to the free ammonia in that sample, which was very high, as it indicated objectionable contamination.

Examination continued: On Nov. 21, 1899, he examined another sample. The appearance was bad, as it had a strong yellow colour; and the chlorides 2·4 parts, which was a much higher figure than it should be. Chlorides would only come originally from contaminating matters introduced into the sample. The oxygen absorbed was also very high—2·15 parts. The microscopic examination showed flocculent organic matter, and infusoria appeared. The water was often worse in times of flood; but the Company ought to provide an installation sufficient to deal with abnormal conditions of the river. This simply meant more or better filters. The ground of his complaint was insufficient purification. The purification should be improved, and the pollution of the river prevented. He did not know where the Water Company took their samples; but he understood it was always at one spot, which he did not think satisfactory. A check ought to be applied at a variety of places. The Company's analysts averaged their results for a month, which produced a false impression. Bacterioscopic analysis was useful as a rough indication of the presence of polluting matters; but he thought its value was greatly overrated, and very unreliable. Efficient filtration, in his view, should include not only the removal of suspended matter from, but adequate purification of, the water. In the Official Water Examiner's report, the water was generally stated to be efficiently filtered, and this led people to think it was efficiently purified, when this was not the case. The question of how the water should be purified was one for engineers. A river polluted by sewage ought not to be used for a water supply, whatever process was applied. Still it could be purified sufficiently for consumption, as was done at Chester. The water there was heavily polluted; but the Water Company dealt very effectively with the unpromising material. A large number of the samples he examined were satisfactory; and if the Company could supply it in this condition at one time, they ought to be able to do so always. They should have sufficient appliances to deal with abnormal conditions when they arose.

Cross-examined: He did not give evidence before either of the last Royal Commissions on the London Water Supply. He had a general idea of the scope of Lord Llandaff's Commission, but did not follow it closely. He was not aware whether Professor Dewar, Sir William Crookes, Dr. Odling, and the late Sir Edward Frankland took samples of water from various parts of the district; it did not appear in the reports. He read the Local Government Board reports, which gave the analysis of each sample. Filtration, if effective and sufficiently carried out, would take out all living organisms; but, no matter how efficient, it would not remove all colouring matter and vegetable impurities. It would, however, remove a very large amount, if it were sufficient to ensure oxidation of the dissolved impurities. He could not accept the statement that vegetable colouring matter in solution was innocuous to health; there were great elements of danger about it. He did not agree that living organisms only were dangerous, as there was considerable evidence to the contrary. Not being a medical man, he could only speak from general knowledge as to what diseases were water-borne; but he should say cholera, typhoid fever, and epidemic diarrhœa. He also believed diphtheria might be propagated by water. He did not, however, know of any instance of disease having been caused by Thames water. He did not examine bacterioscopically any of the samples spoken to; he did not believe in it. If he ever did so, it would be as an addition to, and not in lieu of, chemical and microscopic examination. In the sample of March, 1896, there was nothing in the colour which made the water unfit for consumption, except that it was evidence of contamination. With regard to chlorine as chlorides, dealing with Thames water generally, he had not found such quantities as would lead him to condemn the water on this ground alone, except in one case—that of November, 1899—where it was abnormally high; but it caused considerable suspicion. With regard to saline or free ammonia, he almost always found a small quantity. He was aware that, in the reports published by the Local Government Board since 1891, in no case was free ammonia discovered; but this was merely a question of method. The analysts did not look for it in the way he did; and so they did not find it. He considered their mode of analysis defective on that account. Free ammonia was not injurious of itself, but it was an indication of contamination; and he thought Professor Dewar and Sir William Crookes would probably alter their method in that respect. The same might be said with regard to Dr. Thorpe. If he looked for free ammonia in the proper way, he would probably find it. He did not mind disagreeing with other experts. He had read the report of the chemists who examined the water in March, 1896, for five of the Water Companies. They reported on 182 samples, which were all "clear, bright, and well filtered." He often found them saying that. On the 26th of June, 1896, he condemned one sample as altogether unfit for use, and advised that another should be procured, to which he said, on analysis, that no objection could be taken. He was aware that in December, 1898, Professor Dewar and Sir William Crookes reported that they had examined 256 samples of London water, and, with the exception of one, where there was a defective filter, they were all good. In that month he (witness) reported on one sample as inferior and insufficiently purified; but he did not condemn it altogether. Since then he had made several analyses; and down to November, 1899, he did not absolutely condemn any. He did then, on the general grounds he had already

stated. It was well known that the Thames was a variable river; also that the water supplied from it had been gradually and continuously improving, especially since the institution of periodical analyses in certain districts. Since 1894, the Southwark and Vauxhall Company had carried out, and were still carrying out, large works to increase their storage and filtration area.

In re-examination, witness gave the substance of his monthly reports during 1900. They were generally "fair" or "tolerably fair;" sometimes "fair, to tolerably fair." In no single case was there absolute condemnation.

Mr. *Richards*, clerk in the office of Dr. Kempster, Medical Officer of Health, who was too ill to attend, put in the figures, taken from his books, showing the number of cases of enteric fever in Battersea in certain months—viz., in 1898, Aug. 4, Sept. 7, Oct. 12, Nov. 17, and Dec. 22; in 1899, Aug. 15, Sept. 13, Oct. 18, Nov. 30, and Dec. 25; and in 1900, Aug. 17, Sept. 16, Oct. 19, Nov. 23, and Dec. 16.

Dr. *W. H. Corfield*, F.R.C.P., &c., Medical Officer of Health for St. George's, Hanover Square, said he had read the reports made by Mr. Cassal on the samples of water submitted to him, and agreed with his conclusions that in five cases the water was unfit for consumption. If he had found the same results, he should have come to the same conclusion; and he had himself condemned similar samples in St. George's. For some years he had noticed that enteric fever in the parish, instead of showing itself in August, September, and October—the proper months for it—was more prevalent in November and December, when, in the natural course, it ought to be disappearing. He had pointed this out to the Local Authority, and attributed it to the water in those months being imperfectly filtered. The figures just put in with regard to Battersea disclosed a similar state of facts. He attached more importance to the chemical than to the bacteriological examination of water, because the latter method was not yet sufficiently advanced to allow very sound conclusions to be drawn from it.

Cross-examined: He had no knowledge as to the parts of the parish in which the cases of enteric fever occurred, or what was the total population. Typhoid was essentially a disease propagated from person to person. He did not agree that the figures showed that if the disease was attributable to the water, the supply had been constantly improving. The number of cases had decreased; but many sanitary improvements had been carried out, which made people less susceptible.

By Justice WRIGHT: He attributed the number of cases during November and December to imperfectly filtered water. At that time of year the water was often more polluted, owing to floods, and required more careful filtration.

Dr. *Maurice Hewitt*, Senior Bacteriologist at the Jenner Institute, said he had often examined water with the object of finding the bacillus of enteric fever, but always with negative results. The absence of the bacillus did not, however, show that the water was pure. Repeated researches had been made for this bacillus in water, and there were two or three recorded instances of its having been found; but there was some doubt about them. He did not think it had ever been found at the Jenner Institute.

Cross-examined: If the result of filtration was to remove from 99 to 100 per cent. of the bacteria in water, the probability was that any injurious species would go with the rest; but it did not necessarily follow. He had heard of pathogenic germs being found in filtered water from the Thames; but he could not say exactly when. He had occasionally found them himself, in ordinary samples of water. He believed that filtration, as at present carried out by the London Water Companies, removed from 99 to 100 per cent. of the bacteria present in the water before filtration.

Re-examined: A filter was bacteriologically imperfect which allowed a single bacillus to pass.

By Lord COBHAM: Water might be unwholesome without having bacteria in it; but it would not, in his opinion, produce specific disease, such as typhoid.

Dr. *Corfield* was recalled, and asked by Mr. BAGGALLAY if he knew of any case of an outbreak of cholera or enteric fever where the water had been filtered in a similar way to that adopted by the London Companies. Witness replied that, in his opinion, the prevalence of enteric fever in London in November and December was attributable to that very thing. He could not offhand refer to any other town, where the water was filtered in the same way, in which an outbreak of fever had been traced to the water.

Dr. *A. Wynter Blyth*, M.R.C.S., Medical Officer of Health for Marylebone, said he had had special experience of water examination. He attached great importance to the microscopic examination of water, without which one could not properly appreciate the chemical analysis. He did not consider the bacterioscopic method of much use by itself, but it was valuable in addition to the other tests. He agreed with Mr. Cassal's evidence.

Cross-examined: The value of a bacteriological examination depended entirely on how it was conducted; the mere counting of the number of bacilli was not of much use. The value of a chemical or microscopic examination also depended on the way in which it was done. He did not suggest that Professor Dewar and Sir William Crookes were not capable of carrying out their investigations properly; but they might be liable to error in their interpretation of the results. If their examination included a chemical analysis for the use of the microscope, he should say it was satisfactory; but that did not appear from their printed reports. Bacterial examination was exceedingly delicate, and was valueless, in his view, unless the various organisms were differentiated; and this was not done in the reports he had seen.

Sir *Charles Cameron*, Medical Officer of Health for Dublin, said he had read the analyses of Mr. Cassal, and heard his evidence; and he agreed with the conclusions he drew from his results. Beginning with 1896, two of the samples were very bad, and four very inferior. The two worst were in June, 1896, and November, 1899. He attached more importance to the albuminoid ammonia than to all the other constituents. In his opinion, 0·01 part per million was the highest proportion allowable. He gathered that the defect was due to insufficient filtration and storage; but it might be partly due to floods increasing the quantity of suspended matter which ought to be got rid of by filtration, thus overtaxing the filter-beds. To form a proper conclusion, one must know the maximum and minimum figures, as well as the mean.

Cross-examined: If the figures from which the average was deduced were given, that was sufficient. If impurities entered a river 30 miles above the intake, they would not have the same effect as if they entered much nearer. Dublin suffered heavily from typhoid fever, though it had one of the best water supplies in the world. No one there attributed it to the water; it was a semi-miasmatic disease connected with the soil.

Mr. *Cecil Cribb*, B.Sc., Public Analyst for Fulham, and Analyst to the Mid-Kent Water Company, said he had seen the analyses of Mr. Cassal from March, 1896, and agreed with his conclusions. He did not attach very much importance to bacteriological examination, as it was only an indication of the mechanical efficiency of filtration. The results given pointed to insufficient purification—a matter which was capable of remedy.

Cross-examined: He had himself conducted bacteriological examinations from time to time. If he found pathogenic germs in water before filtration, and failed to find them after, he should be satisfied that the filtration was efficient.

Mr. EARLE said this was the case for the complainants. In reply to the Court, he said there had been complaints during 1900.

Justice WRIGHT having intimated that the Court would like to have the evidence of the respondents before hearing any remarks from Counsel,

Mr. *J. W. Restler*, Engineer to the Southwark and Vauxhall Water Company, was called, and produced a table showing the capacity of the reservoirs, the acreage of the filter-beds, and the average rate of filtration at the various periods from 1894 to the present time. In 1894 the capacity of the reservoirs was 46 million gallons; it was now 436 millions, and contracts had just been entered into for the construction of additional reservoirs equal to 1070 millions. In 1894 there were 18 filters; in June, 1899, they were increased to 25. Six more would be taken into use within two months; but those at Battersea would then be discontinued. The average rate of filtration per square foot per hour had been gradually decreased, and was now 1·36 gallons. Filtration went on practically continuously night and day; and the water went directly from the filters into wells, and thence to the consumers. When the river was in a bad condition, the water did not go direct from it to the filters, which were charged from the subsiding reservoirs; and these were filled when the river was in an average condition. The Company supplied water to many districts having their own analyst; and since 1890 he did not know of any complaint from other districts than those before the Court. In 1890 there was one from St. Saviour's, Southwark. The same water went to all the districts. Out of the total acreage of filters, about 2 acres would be out of use at one time.

Cross-examined: There was no great difference, either in the population or in the quantity of water supplied, since 1892; in fact, the population was larger then. It was on his advice that the Company obtained powers in 1898 to largely increase their storage capacity. This was owing to the recommendation of Lord Balfour's Commission that the Companies should come under certain conditions as regarded the minimum quantity to be allowed to flow over Teddington Weir. It became necessary to provide for storing water when there was a surplus, in order to have a supply when there was a minimum rate of flow. They had already ample storage capacity for purposes of purification. It was intended to close the works at Battersea, and concentrate the whole of them at Hampton; and it was for this reason that the additional filters there were required. The average rate of filtration per square foot per hour in 1892 was 2·75 gallons.

Re-examined: The proper rate of filtration was a question of experience, depending upon the quality of the water to be dealt with. The Official Water Examiner suggested 2 gallons as a safe figure; and this was generally accepted. When the river was very dirty, the water was not taken in at all. The filter-beds were cleaned continuously throughout the year in rotation; there were always two, and sometimes three, out of use, for a day at a time. It would take less than eight hours for the water to reach Battersea from the works.

Thursday, Jan. 24.

On the resumption of the proceedings this morning,

Sir *William Crookes*, F.R.S., was the first witness called. He said that for a great many years he had examined the Thames water—commencing fifty years ago—and had made daily analyses for the Water Companies since 1881. He was then associated with the late Dr. Tidy and Dr. Odling. In 1885 the value of the bacteriological method was recognized; but it was a delicate process, and they did not publish any results until 1894. The bacteriological examinations were at first made weekly; but for some time past they had been made daily. In many cases, three or four samples from each Company's supply were procured in different parts of the district. Whenever there was a complaint, samples were taken on the spot and in the vicinity. The water was also examined chemically; the main points determined being the organic carbon and nitrogen, adopting the plan devised by the late Sir E. Frankland—perhaps the greatest authority in the world on water analysis. The higher the proportion of organic carbon to organic nitrogen, the better the water, because it showed principally vegetable matter. If the proportion of organic nitrogen were high, it indicated animal matter. They always examined for free ammonia, but very seldom found it—in only 6 cases out of 2834 within the last ten years. They did not test for albuminoid ammonia, as its presence did not indicate whether the organic matter was animal or vegetable. He considered this test not only untrustworthy, but misleading, and it was discarded by Sir E. Frankland and Dr. Tidy. The colour of the London water as it left the filter-beds was generally very good—far better in this respect than that supplied from Thirlmere, Loch Katrine, or Lake Vyrnwy. Even at its worst, it was of better colour than that supplied at other places which justly prided themselves on the purity of their water supply. Colour was chiefly due to the presence of peaty matter, and was perfectly harmless. The larger portion of the matter suspended in Thames water was of vegetable origin; that from animal sources was very much less, and could scarcely be detected. He did not agree with Dr. Corfield that the prevalence of typhoid in November

and December was due to the water. He had extracted from the Registrar-General's returns the number of typhoid cases in each of the districts supplied by the London Water Companies, which in some cases overlapped, and he found that the proportion of deaths from typhoid per 10,000 of the population was highest in districts served by Companies admittedly supplying the best quality of water, such as the New River and Kent Companies. The death-rate in the district supplied by the Southwark and Vauxhall Company was almost the lowest, and it was much higher in Dublin, Liverpool, Manchester, Glasgow, and other towns, than in London. It was evident to his mind that typhoid disease in London had nothing to do with the water supply. With regard to bacteria, the flow of the river itself, with exposure to the air and sunlight, tended to reduce the number.

Justice WRIGHT said they need not go into the whole theory of the matter. The Court only wanted to know whether the water supplied by the Company answered the description of pure water, or whether there was any defect in the filtration.

Witness said he had no doubt at all that the water supplied by the Company was pure and wholesome; and the system of filtration was very good. Each Company had slight differences in the area and depth of sand; but he thought the Southwark Company was one of the best. Certainly the water was effectually filtered. In the monthly reports prepared in conjunction with Professor Dewar, they gave the details of each examination. In November, 1899, they made a complete analysis on the 20th. A bacteriological examination was made daily of the water supplied by each Company, and a complete chemical analysis daily of the water supplied by one Company, taking them in turn. On the 21st of November, two samples of the Southwark Company's water were taken. One from Battersea was absolutely sterile; and one from Hampton had 5 bacteria per cubic centimetre. With such a small number as this, they did not take the trouble to investigate further; but if there were a large number, they tested for pathogenic species. According to the report, the water from this Company on the 20th of November had no matter in suspension. This had always been the case practically for some years past. He did not say that the vegetable and mineral *débris* found by Mr. Cassal was all imaginary; but he and Professor Dewar did not find it. By taking an enormous quantity of water, and passing it through a very fine filter, traces of residue might be discovered; but they simply examined the water in a 2-feet tube, and if they found no turbidity, they said so. In November, 1899, 267 samples of water were examined bacteriologically, and the results of each examination were given. The same might be said with regard to the chemical examination.

Cross-examined: In November, 1899, the result of the chemical analysis showed 0·278 part of organic carbon per 100,000 parts, and 0·043 part of organic nitrogen. This was a pure and wholesome water. Sir E. Frankland gave 0·322 part of organic carbon and 0·032 part of organic nitrogen as occurring in unpolluted upland surface water. Such water might be very peaty. The quantities he had found did not point to the water not being pure or wholesome, but to peaty water. The watershed of the Thames was very large, and some peaty matter might get into it. If the proportion of nitrogen to carbon was about 1 : 7 or 1 : 8, this showed that the organic matter was vegetable and not animal. Organic nitrogen did not necessarily show the presence of animal matter. Even with organic nitrogen as high as 0·1, if the organic carbon were seven or eight times as much, it would denote a pure and wholesome water. No one test was sufficient, and no combination of two. The whole analysis must be taken, and the bacteriological examination as well, to form a sound judgment. Before the bacteriological method was introduced, judging by the chemical analysis, the whole circumstances had to be taken into consideration. Free ammonia, if present, was suspicious; but they only found this in nine cases. They did not test for albuminoid ammonia, although many analysts did. Sir E. Frankland spoke most strongly against this test. Dr. Thorpe had given the figure for albuminoid ammonia, for the first time, he believed, in his last report; but he (witness) did not know what inference he drew from it. It was true Dr. Thorpe spoke of albuminoid ammonia as "a measure of organic nitrogenous pollution." He (witness) had the highest opinion of Dr. Thorpe, and he thought he would not have used this phrase if he had seen the evidence against it. He considered the test misleading. If 90 out of 100 water analysts differed from him on the matter, so much the worse for them. Chlorine, if in excess, was an indication of excretal matter, principally urine. Being a constituent of salt, a small quantity was always present in water near the sea. The oxygen required to oxidize the organic matter was a test of impurity; but 0·076 part was not a high figure. It might be higher than many of the other figures; but slight differences in the second place of decimals were practically of no importance. At this point the witness was cross-examined at some length with regard to the organic carbon and nitrogen; but he adhered to what he had already stated —that the proportion between the two was the really important point. Going to the bacteriological tests, the highest number of microbes per cubic centimetre they had found was 140. When they first initiated this test, they laid down as a rough standard that if the water contained 300 or 400 microbes it should be noticed. Then, as the methods of filtration improved, the standard was reduced to 200, and more recently to 100. Whenever this was exceeded, the particular Water Company was notified. He produced the laboratory book giving the details of these examinations. On Nov. 20, 1899, they found one microbe per cubic centimetre; on the 21st, none. They frequently found the water sterile. They were thinking of reducing the limit from 100 to 50, as the water was getting so much purer bacterially. The witness was then cross-examined as to the state of the water on Dec. 22, 1898. The sample was taken at St. George's, in the Borough, and the organic carbon and nitrogen were 0·344 and 0·056. The proportion was satisfactory, and the amount was not large absolutely, though higher than the average of Thames water. The river varied very much, and there would be three or four times as much organic carbon in winter as in summer. On other days, about that time, the figures were similar. The oxygen absorbed was in one case 0·083 part, in another, 0·079 part. This did not point to pollution, but to the presence of peaty matter. In the absence of such matter, it might indicate pollution.

Justice WRIGHT again intimated that the important question for the Court was what was happening now.

Witness, in reply to further questions, said he judged of the action of the filter-beds simply by the tests applied to the water; but they were in telephonic communication with the Engineers of the Water Companies, and if any particular filter was found to be not working satisfactorily a message was sent at once, and it was put out of use. The filter-beds were tested in rotation; each bed being examined about once a week. If anything suspicious occurred, they were all examined. Curiously enough, a filter-bed was not at its best immediately after being cleaned; it required a little bacterial scum on the surface, because the bacteria were so minute that they would pass through pure sand. But when they got a layer of gelatinous substance on the surface, it obstructed the bacteria. With regard to 1900, the highest number of bacteria found in the Southwark Company's water was 362, which was at a time of flood, after drought. All the Water Companies were affected. The effects could not have been prevented by more filtering area or a better system, but they might have been by greater storage capacity. The increased storage now being provided would have a very considerable effect. The figures for oxygen absorbed, in February, 1900, suggested a large quantity of peaty matter brought down by the rain, not pollution.

Re-examined: He should say that an enormous number of pathogenic bacteria would be required to do any harm. He did not suppose any one could walk down Fleet Street any day without taking in a large number by the mere act of breathing. His position and that of Professor Dewar with regard to the Water Companies was quite independent. All the Companies did was to pay the expense of the examinations and a small sum—about £150—for incidental expenses; it could not be called a salary. They took the samples when and where they pleased, and had no communication with the Companies except to notify them if anything was going wrong. The Companies only had the reports after they were printed. The standard adopted of 100 microbes to the cubic centimetre was simply a guide as to giving notice, not an indication of impurity. They gradually tightened the screw as the Companies were doing better work. His experience convinced him that the water was thoroughly well filtered, though there were one or two instances when it was not so well filtered as it might have been. Pathogenic bacilli were, he believed, all vegetable. They were always in suspension, and were too small to be detected by chemical means. For this reason he pinned his faith to the bacteriological test as the only effective one.

In answer to Justice Wright, witness added that he should not say the water of the Southwark Company was better than that of any of the other London Companies; neither should he say it was worse.

Professor *Percy F. Frankland* said he knew of no test so good as the bacteriological one in the case of surface water like that of the Thames. In such a case, chemical examination was quite inadequate as a test of whether or not the water was fit for consumption; but such tests, when taken regularly for many years—and these had been going on since 1867—were valuable as indicating the condition of the river from time to time, and showed whether the quantity of organic matter was decreasing. He believed the water supplied to London was perfectly wholesome; no one had ever been able to show that it was not. He had visited the works of all the Companies, and examined the water both before and after filtration, and from each individual filter-bed. The system adopted by the Southwark Company was similar to that pursued by all the others; in fact, it had been adopted all over the world. He knew the water-works of all the principal towns, and was not aware of any system which was better than that adopted by this Company. He knew the water at Chester, and, as regarded the removal of bacteria, it did not compare favourably with the London water. The water required more careful filtration in winter than in summer, because there was more suspended matter. The area of the filter-beds should be calculated for the most unfavourable conditions. The rate of filtration here was much lower than that often adopted. He agreed with Sir William Crookes that the test for albuminoid ammonia was worthless. He should never think of basing an opinion upon the result of that test.

Cross-examined: He did not say that all the tests of water made before 1894, when the bacteriological method was introduced, were quite valueless; but one could not say, from chemical analysis, whether any particular water was fit or unfit for consumption, because it would be quite possible to introduce into a sample a minute quantity of pathogenic bacteria, and the chemist would not be able to detect it. Pathogenic bacteria could be, and had been on many occasions, distinguished from harmless organisms. Sir William Crookes made qualitative as well as quantitative examinations, though the results did not appear in the printed reports. Plenty of wholesome waters contained large quantities of ammonia; and he should not condemn a sample on account of the presence of free ammonia. No one item in a chemical analysis of a water would lead him to condemn it. If he found a river water contained a large quantity of organic carbon, and nitrogen, and free ammonia, he should say that the river received pollution, probably of an animal nature; but unless the proportion was so large that the organic matter was *per se* deleterious, if the water were properly filtered it might be perfectly wholesome.

Professor *James Dewar* said he was a member of Lord Balfour of Burleigh's Commission on the London Water Supply, which went very fully into the question of storage and filtration, the sources of pollution, and the steps which should be taken to prevent it. In his opinion, Thames water, if properly filtered, was pure and wholesome. Since the retirement of Dr. Odling, he had been associated with Sir William Crookes in analyzing the London water. That supplied by the Southwark and Vauxhall Company was, as a rule, pure and wholesome, and effectually filtered. If ever there was any defect in filtration by any of the Companies, it was mentioned in the report. Before joining in the work, he made it a condition that the bacteriological method should be adopted and extended, being satisfied of its efficacy as introduced by Dr. Koch, of Berlin. He showed how to count the number of bacteria in a given volume of water; and there was no doubt about its being the most stringent test of the efficiency of filtration. It was now adopted all over the world. Bacteriological examination was, however, a delicate and troublesome process to conduct; and therefore it was not a method which could be adopted by everyone. It was quite a different thing from an ordinary chemical analysis. The water from the Thames varied very much. In the summer, three-fourths of it was spring water, which had

been filtered through the chalk in the valley of the river, which embraced an area of about 4000 square miles; the greater portion being oolitic or chalk. In the winter months, when all this storage area had been depleted, it was refilled by heavy rains and floods; and naturally at that time the water was more charged with vegetable matter, which accounted for the deeper colour. Since the Balfour Commission, a great deal of pollution had been kept out of the river; and its condition had consequently improved. The analyses showed that the filtration had been good.

Cross-examined: The Companies were not wasting their money by providing additional storage and filter-beds. If the water had not time to purify itself by sedimentation in the storage reservoirs, the filters became rapidly clogged, and had to be more frequently cleaned; and it was desirable to interfere with them as little as possible. Even in flood times, the Thames water was satisfactory after filtration. In one case, in February, 1900, the bacteriological test showed 992 microbes per cubic centimetre; but this was caused by a mechanical defect in a filter belonging to another Company. No artificial mode of treating water was absolutely perfect; and even in the natural chalk there were occasionally crevices which allowed objectionable matters to pass. He should say 2·4 parts of chlorine as chlorides per 100,000 parts was very high; but there was nothing abnormal about 2·2 or 2·3 parts.

Re-examined: The examination in February, 1900, when so many microbes were found, was not of water supplied by the Southwark Company. The name of the Company was not mentioned in such cases; but it was recorded, and supplied if asked for.

By Justice WRIGHT: The water in some of the city wells, such as that below Aldgate pump, which was condemned some years ago, although apparently bright and clear, must have been full of bacteria. Nothing had been proved more definitely than this—that the conveyance of disease by water was due to living organisms. It was only quantitative bacteriology which enabled one to say whether, in the act of filtration, anything had occurred which interfered with a 99 per cent. efficiency. There might be thousands of bacteria per cubic centimetre in Thames water; and the storage and filtration arrangements must be such as to reduce the number to 100. Filtration did not remove soluble organic matter.

Justice WRIGHT: Filtered water, apparently, might contain a considerable amount of soluble organic matter which had come from the bodies of animals, human or otherwise, and yet be entirely pure and wholesome; and a river might consist of an aqueous solution of excreta, and yet show nothing wrong by the bacteriological test?

Witness said bacteriology would not show that. It only showed whether those constituents which convey disease had been removed. The other constituents which were in solution were oxidized and transformed in the course of the river itself.

Justice WRIGHT said the Court did not desire to hear any argument from Mr. Baggallay, but would listen to what Mr. Cripps had to say.

Mr. CRIPPS submitted that, on the evidence, it had been shown that on certain occasions water not pure and wholesome had been supplied; but he admitted that he could not ask for any order going beyond what the Company were now proceeding to do. He submitted, however, that, under all the circumstances, the Vestry were justified in making the application.

Justice WRIGHT, having briefly conferred with the other Commissioners, delivered judgment. After reading sub-section 2 of section 1 of the Metropolis Water Act, 1897, and the sections of the other Acts imposing an obligation on the Company to supply pure and wholesome water, effectually filtered, he said: We start with this, as a matter of fact, that the highest possible standard—a standard of absolute purity and absolute wholesomeness—cannot be expected, so long as the Companies are entitled to draw their main supply from a river like the Thames. This Act cannot possibly intend that we ought to interfere, or should have the power to interfere, in a case in which effectual interference could only produce the infinitely greater evil of the total stoppage of the supply of the district. We must start on the assumption that the Company owe their only powers for giving a sufficient supply of water to the district to Acts of Parliament which authorize their supply being drawn from the Thames, and therefore necessarily under some liability to impurity. On the other hand, that very necessity that the water must come from a more or less polluted source makes it all the more important that the Court, in the exercise of its jurisdiction, should, where a sufficient case is made out, insist that every possible precaution should be adopted to remove the impurities or any elements of unwholesomeness which, from the nature of the source of supply, must always be more or less likely to be found in the water. I am very far from saying that we might not interfere to some extent upon proof of negligence, even in a single instance. I suppose that one thoroughly defective filter might conceivably be the means of conveying a deadly poison to a very large portion of the population, and might operate for a long time. I do not at all think the case would necessarily break down because only a single instance of bad filtration, or anything of that kind, could be proved. At the same time, even in protecting such vital interests as these, the Court must proceed with the utmost caution, and without injustice; and if we find that the slips in the practice of filtration have been rare, and are not recent, and especially if we find that the Company are now doing, and have been for some time doing, all they can to render the occurrence of such slips impossible, and to secure, so far as practicable, an unfailing supply as pure and wholesome as Thames water can be made, we should be wrong to make any order which could not have any useful effect. Now, here there is a certain conflict of evidence, and yet no conflict, because the experts for the applicants rely upon one process, and those for the Company upon another. They do not really conflict in their statements of scientific facts, but differ only in the inferences they ask us to draw from them. The inference I draw is that, so far as what has been called here pathogenic bacteria are concerned, this water is practically free from them, except under very exceptional circumstances which are not likely to occur. On the other hand, I should draw the conclusion—which, I think, is not in the least degree denied by Professor Dewar—that water, even after the best filtration the Company can provide, contains elements which none of us would wish the water we are drinking to contain, and to such an extent that a simple aqueous solution of the soluble organic matter of excreta would appear pure and wholesome. Happily this case does not depend upon any such extreme view of the facts, because, by the applicants' own showing, in the last two years there has been only one day on which the water supply was, according to the chemical tests on which the applicants relied, so bad that it actually ought to be condemned, and that one case was in November, 1899, which is now more than thirteen months past. The applicants, who have conducted their case with complete fairness, have not made any suggestion of any specific fault in the existing filtration or in the existing system of reservoirs; and that, to my mind, is almost the strongest ground for not interfering. We could only interfere here if it were shown that the Company were doing something actually wrong, or not doing something the omission to do which would be a reasonable cause for our interference. There is strong scientific evidence that, even in the case in which flood waters have found their way into the reservoirs or filter-beds, no really injurious pollution resulted. Much as I respect the evidence given by Dr. Corfield, I do not think it was proved, in such a way that we could act upon it, that the connection between enteric fever and the contamination of the water of this Company is so clearly established as he thinks. No doubt there was some reason to suspect that there might be more connection than the other side admitted; but it was not established. There are very few instances, even in the last eight or nine years, in which it was established that so large a proportion of flood water had got into the reservoirs that it could not be effectually dealt with by filtration. We find that the Company, under the powers which they have recently obtained, are actually engaged in trebling their reservoir area, which will enable them to dispense with taking in any water during periods of Thames flood, and thereby avoid the principal source of danger which has hitherto existed. In addition to this, they are increasing considerably their filtration area, which in future will consist of something over 30 acres of filters, and will reduce the rate of filtration from what it was in 1895—viz., 2 gallons per square foot per acre—to 1·36 gallons. Sir Frederick Peel doubts whether, after the Battersea filters are given up, the total number would be greater; but I think I am right in this, at all events, that the rate of filtration per square foot per acre will have been reduced to 1·36 gallons.

Mr. RESTLER: Not quite that, my Lord. It will be somewhere about 1·68 gallons.

Justice WRIGHT: Such as it is, we are told there will be a sufficiently slow rate of filtration to satisfy all the requirements of the case. At any rate, the new works of the Company will be a very great improvement on the old ones; and in this vital respect—that, with increased reservoir capacity, there will be less necessity for an extreme amount of filtration. Under these circumstances, the Company appear to be doing the very things which, if the Court could do it, we should be inclined to order, and probably more than, under any circumstances, we should order them to do. The case made against the Company, in our judgment, has failed; but I do not think it is a case in which the applicants ought to be made to pay the costs. This is new jurisdiction which, in the public interest, should be tried, so long as it is not tried recklessly, and without some ground. Here we cannot shut our eyes to the fact that, in recent times, there have been failures on the part of the Company to exclude flood water, and I for one cannot say that the applicants were not fully entitled to raise this question here.

The application was therefore dismissed, without costs.

Mr. CRIPPS stated that it would not, in his opinion, be right (after his Lordship's judgment) to go into the Lambeth Case, which was substantially the same as the Southwark.

A similar order was accordingly made in that case also.

Appeal by the Barnstaple Gas Company.

In a Divisional Court of the High Court of Justice last Tuesday, Justices Bruce and Phillimore had before them the case of *Pine v. Barnstaple Gas Company*, which was an appeal by defendants, from the Barnstaple County Court, against an order for specific performance. The proceedings in the Lower Court were reported in the "JOURNAL" for Sept. 4, 1900 (p. 586). Mr. Bodilly appeared for the appellants; and Mr. Hawke for the respondents. Counsel said that in the early part of last year the Company had a leasehold, with a power of purchase, of No. 79, Wilport Street, Barnstaple, at the rear of which was land they wanted to take over. They entered into negotiations with the owner (the plaintiff), and agreed as to price. Before the contract was concluded, it was discovered that somebody had a right of ancient lights, which would have prevented the Company from erecting buildings, and that there was also a right of easement which would have interfered with their free use of the land. They intimated that they could not purchase the property, which would be useless to them. Plaintiff then took proceedings in the County Court, where the Judge found that the defence set up wholly failed, and the plaintiff was entitled to specific performance. Counsel now submitted that this decision was wrong, as there was no contract signed by two Directors, as was required by the Lands Clauses Act. Their Lordships allowed the appeal, with costs; and they granted a further application to appeal—the claim involving upwards of £400.

Prepayment Gas-Meter Improvements.

It will be remembered that in the case of Ward, Whitham, and Co., Limited, and Edward Large v. Whitham, the plaintiffs on the 14th inst. obtained, at the Manchester Sittings of the Chancery of Lancashire, an injunction for a week restraining the defendant, Challenger Whitham, from selling or disposing of or otherwise dealing in any manner with certain letters patent numbered 5708, and dated Jan. 20, 1900, for improvements in prepayment gas-meters, or his share or interest therein, except by assigning the same to the plaintiff Company. On the case coming before the Court yesterday week, Mr. Tweedale, who represented the plaintiffs, informed Vice-Chancellor Hall that the defendant, who did not appear on the previous occasion, would consent to the injunction already granted being continued until the trial of the action on the usual undertaking of the plaintiffs in damages. Mr. Radford, who represented defendant, intimated that this was so; and the Vice-Chancellor made an order accordingly.

In re Coventry Gas-Fitting, &c., Company.

A petition for the winding up of this Company came before Mr. Justice Wright last Thursday. Mr. Romer stated that, since the presentation of the petition, resolutions had been passed for voluntary liquidation, and a scheme of reconstruction had been prepared, to which he understood the creditors assented. Under these circumstances, the petitioners were willing to take a supervision order. His Lordship made an order continuing the voluntary liquidation, under supervision.

The Question of Notifying an Increase in Price.

At the Thames Police Court, last Wednesday, before Mr. Mead, the Mayor, Aldermen, and Councillors of the Borough of Stepney were summoned by the Commercial Gas Company for £917 8s., on account of gas supplied. Mr. Young appeared in support of the summons; Mr. Birchall represented the Council. Mr. Young stated that the proceedings were taken under section 53 of the Commercial Gas Company's Act of 1875, by which the Company were authorized to raise the price of gas; and he maintained that no notice of such increase was required to the defendants. Mr. Birchall admitted the amount claimed, provided that notice was unnecessary. The defendants paid less than private consumers, and when the Company raised the price to the latter the parish price was not increased. He argued that there was practically a quarterly agreement between the parties, and that therefore his clients were entitled to notice. He further submitted that alteration could not be made in the currency of a quarter; but even if it could, notice should be given. Their agreement was that £3 5s. 6d. should be paid in respect of each lamp—this figure including the charge for gas, painting and maintaining the lamps, and lighting and extinguishing them. Mr. Mead eventually adjourned the case for the production of statements showing the reductions to private consumers and to public bodies.

Brentford Gas Company.—The balance to the credit of the net revenue account of this Company will enable the Directors to recommend the payment of dividends for the past half year at the rate of 5, 12, and 9 per cent. per annum.

Gas v. Electric Motors.—At a recent meeting of the Board of Management of the Swansea Hospital, a discussion took place on the merits and cost of electric and gas motors. Colonel Morgan said that whereas a 7-horse power electric motor would cost 1s. 9d. per hour, a gas-engine would only cost 5d. It was decided to purchase a gas-engine.

Aldershot Gas and Water Company.—At the meeting of this Company on the 8th prox., the accounts to be presented will show that the total revenue for the six months ending Dec. 31, 1900, was £21,888; and the expenditure £16,853—leaving a surplus of £5035. The balance available for distribution is £9115; and the Directors will recommend dividends at the rate of £11 8s. 6d., £8 8s. 6d., and £7 per cent. per annum on the "A," "B," and "E" shares, all less income-tax. In their report, the Directors state that the Company's business has increased in all branches.

A Supply of Gas Wanted for Shadwell, near Leeds.—Last week, a deputation from the Shadwell Parish Council waited upon the Leeds Corporation Gas Committee, to request them to supply the township with gas. The question had previously been before the Committee, who had found that to provide the supply asked for would necessitate the expenditure of something like £4000 upon mains; and the Committee felt that without some aid from the Parish Council they would not be justified in incurring such an outlay. It was stated that the whole population of Shadwell was about 1000; and that there are probably not more than 200 householders of all classes. The Committee decided not to entertain the proposal, at all events at present.

Claim for Loss Incurred through the Failure of a Gas Supply.—The recent failure of the gas supply at Coalville has brought trouble upon the District Council, the owners of the gas-works. At their meeting last Tuesday, the Clerk read a lengthy letter from a firm of engineers (Messrs. Stableford and Co.) complaining of the failure of the gas supply, in consequence of which several hundred of their workpeople had been unable during the past few days to work in the early morning and at night, which had meant a loss of from £250 to £300 in wages alone. Messrs. Stableford added that the Council were financially responsible just as if the gas undertaking belonged to a company; and they would hold the Council responsible to reimburse any loss they sustained in consequence of the failure of the supply. The letter was referred to the Clerk for his advice upon the question. Mr. W. Lindley, the Chairman of the Gas Committee, said that after Wednesday they hoped to have a continuous supply of gas. Mr. O. Lindley said he had heard that the works were in a very bad state; and if this were so, they should call in an expert to discover what was wrong. He moved accordingly. An amendment that the question be deferred a week was, however, carried by the Chairman's casting vote.

Incandescent Gas Lighting in Norwich.—At a recent meeting of the Norwich Town Council, a report was received from the Executive Committee, recommending that, the 97 lamps, fittings, and burners fixed by the Street Lighting Company, Limited, of Liverpool, for three months, for experimental purposes, having proved satisfactory to the City Engineer, as Arbitrator, the lamps, fittings, and burners be purchased at a cost of £218 15s. 11d., and that the experiment of lighting by incandescent gas-burners be continued for a further period of nine months with the above-named Company to supply mantles and fittings, and to light and extinguish the lamps, and with the British Gaslight Company, Limited, to supply gas, upon the same terms and conditions as were made with these Companies on April 10, 1900. Mr. Cunnell, in moving the adoption of the recommendation, stated that the cost of maintaining the new lamps was £3 6s. 6d., against £3 7s. 9d.; but they had extra light for 1s. 3d. less than the old light had cost, though, of course, they had to purchase the lamps. Mr. Williment inquired whether any further steps had been taken to utilize the poles of the Tramway Company for electric lighting. Mr. Cunnell said the matter had been considered; but the incandescent gas was much cheaper than electric light. The report was adopted.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY.

Half-Yearly Report.

The following is the report on the working of the Company in the six months ending Dec. 31, 1900, which, with the accounts for this period (to be given next week), will be submitted to the proprietors at the half-yearly general meeting on the 8th prox.:—

The accounts for the past half year show that, after providing for the fixed charges, there remains a balance available for distribution of £551,753 10s. 6d., out of which the Directors recommend a dividend on the ordinary stock at the statutory rate of £4 8s. per cent. per annum, carrying forward the sum of £221,570 10s. 5d. to the credit of the current half year.

The Directors are able to report a very satisfactory increase during the half year in the number of the Company's consumers; there having been an addition of 1527 on the ordinary system of supply, and 6371 on the prepayment meter system. But, notwithstanding this increase, there has been a considerable falling off in the sale of gas, amounting to 6 per cent. This decrease is to be attributed to the abnormally high temperatures which prevailed throughout the half year, especially during the month of December; to the extensive adoption, by both public authorities and private consumers, of more economical systems of lighting by means of incandescent and other high-power burners; and, in some measure, to the necessary and temporary increase in the price of gas.

The prices realized during the half year by the sale of coke have been satisfactory; but, during the past few weeks, owing to the mildness of the season and the fall in the price of coal, the current prices of coke have shown a considerable reduction.

The revenue from the sale of tar products has been fairly maintained; but, owing to the prolongation of the war in South Africa, the suspension of the gold-mining industry there has continued to restrict the sales of cyanogen products, and has thus seriously reduced the revenue under the head of "Ammoniacal Liquor."

On the expenditure side of the revenue account there are two items which call for special notice—namely, the cost of coal and the amount of expenditure on wear and tear account. The price paid for Durham coal has been 18s. 8d. per ton, and shows an increase, as compared with the price for the December half year of 1899, of 6s. 8d. per ton. It is, however, very satisfactory to the Directors to be able to report that there has already been a considerable fall in the price of gas coal; and that they have good reason to anticipate that, before the date of the expiration of the Company's existing contracts, they will be able to arrange for next season's supplies of coal at prices materially lower than those of last spring. The extra charges on wear and tear account are for reconstructional works now being carried out at several of the Company's stations, which will produce economy in working.

The quinquennial re-valuation of the Company's undertaking is now complete; and the Directors have been able to obtain, from the various Assessment Committees, terms somewhat more favourable to the Company than those obtained at the last quinquennial period.

In order to provide for the expenditure in connection with the extension of the ordinary business of the Company, the Directors, in October last, offered for sale £125,000 of ordinary stock and £100,000 of debenture stock. Of the ordinary stock, £86,810 was taken up at or above the reserved price of £100 per cent.; and of the debenture stock, £69,450 was taken up at or above the reserved price of £94 per cent., leaving unsold balances of £38,190 and £30,550 respectively.

To meet the present requirements of the Company, the Directors had decided to offer for sale a further sum of £125,000 ordinary stock; but, as the price of the stock has now fallen to a discount on the market, and as the Directors are precluded by the Company's Acts of Parliament from issuing ordinary stock at a price below its nominal value, the sale which had been announced was necessarily postponed.

The Directors have again deposited a Bill for raising additional capital, to the amount of £1,000,000, to meet the expenditure necessary to enable the Company to fulfil its parliamentary obligations for the next four or five years throughout its district of supply. The capital is proposed to be raised, as last year, by the issue of 3 per cent. debenture stock, and, with one important modification, the general provisions of last year's Bill are embodied in the present Bill. The modification is the introduction of provisions for the redemption of capital out of the profits of the Company available for the payment of dividend on the ordinary stock of the Company in excess of 4 per cent. per annum. These provisions have been inserted with a view of complying with the fifth recommendation of the report of the Powers of Charge Committee of 1899. Should the sanction of Parliament be given to this proposal, the consumers of gas in the Company's district will obtain, year by year, an increasing advantage in the way of a reduction in the charge for capital. This Bill will, in compliance with the Standing Orders, be submitted to the proprietors for their approval at an extraordinary general meeting to be held immediately after the ordinary meeting.

Several Bills will, in the ensuing session, be submitted to Parliament for powers to construct and work electric railways and tramways within the Company's district, and, as the working of such undertakings may be a cause of damage to the Company's property, the Directors of this Company, acting with those of the other Metropolitan Gas Companies, are taking the steps necessary in order to obtain from the Board of Trade such regulations as may best protect the interests of the Company. The South Metropolitan Gas Company has again given notice of a Bill by which are sought permissive powers to purchase, by agreement, this Company's district of supply and works south of the Thames. A similar application by that Company was submitted to Parliament in the first session of last year, but failed to obtain the sanction of the Committee of the House of Lords to which it was referred. These Bills will be carefully watched by the Directors with a view to obtaining proper protection for the interests of the Company.

The Court of Directors has been furnished by the several Engineers

of the Manufacturing and Distribution Departments respectively with the usual certificates that all the Company's plant has been maintained in thorough efficiency.

A ROYAL VISIT TO A GAS-WORKS.

An Interesting Incident.

The following extract from an article which appeared in the "JOURNAL" for March 18, 1856, will doubtless be read with interest in conjunction with the important national events of the past week.

Not many weeks ago, a letter was received in the evening by the officers of a certain gas-works, which letter informed them that next day the sanitary Socrates of the district would favour them with his company for the purpose of determining whether, in addition to coal gas, they did or did not also manufacture cholera, typhus, and all the other "ills that flesh is heir to." Next day, true to his appointment, Socrates came, and, "Fee, fah, fum! he smelt the smell of a working man;" then evaporated in considerable trepidation to write a report, the value of which cannot be expressed in figures, and will probably, therefore, never be known. By a strange coincidence as to time and circumstance, a letter was received on Monday evening, March 10, announcing to the authorities of the Chartered Gas Company, that on the following day his Royal Highness the Prince of Wales would visit the Westminster station of the Company, and inspect the process of manufacturing gas. Next day came, and with it, sure enough, a goodly and distinguished group of visitors, including his Royal Highness the Prince of Wales, the Prince Alfred, Colonel Phipps, and Mr. Gibbs, the accomplished tutor to the princes. They were duly received by the Governor (Benjamin Hawes, Esq.), the Deputy-Governor, a majority of the Directors, the Secretary (Mr. Burls), and the Consulting Engineer of the Company (George Lowe, Esq.); while to the Superintendent of the station (F. J. Evans, Esq.) was confided the important task of conducting the distinguished party over the works, and explaining the various operations of the manufacture of gas. Suffice it to say, that everything was seen, inquired into, and comprehended by the royal strangers—the retorts, condensers, and purifiers were all shown in full action; a small experimental apparatus, in which the process of making gas was exhibited on a minute scale, elicited much admiration; and the comparative values of the cannel and common gases made at these works were seized upon with an intelligence and avidity that seemed almost to imply a previous acquaintance with the details of photometry. The distinguished party remained more than an hour and a half, and quitted the works evidently much gratified with their visit; the proof of which has since assumed a tangible form in the shape of a very flattering letter of thanks to Mr. Evans for his attention on the occasion.

Much might, no doubt, be said, of an extremely laudatory nature, in favour of that paternal wisdom which thus seeks to establish a lasting bond of sympathy and knowledge between the heir apparent to the throne and the people over whom it will, we trust, one day be his lot to preside. But, at present, we must overlook the merits of the father to point out the rising characteristics of the son. During the sojourn of the Prince of Wales in the retort-house, it was, of course, necessary to exhibit that fiery, and indeed fearful, operation called "drawing the retort." A bed of eight retorts was, therefore, chosen and begun with. The workmen, perspiring from heat and labour, and surrounded as usual by smoke, had finished the drawing of five, when Mr. Evans, judging that the process could not be otherwise than highly inconvenient to the Prince, offered to conduct him to another part of the building. "No," said he, with composure and significant firmness, "I should like to see those other three retorts drawn;" and they *were* drawn before he would move from the spot!

This is, we believe, the first visit of British royalty to a gas-works in this country. May it be the prelude to many more, until popular ignorance and prejudice are convinced that a manufactory has no more right to be called a pest-house, than a sanitary inspector has to be regarded as a philosopher.

THE PRICE OF GAS NORTH OF THE THAMES.

More Agitation by Consumers.

A Conference, convened by the Gas Consumers' Protection League, was held at the Mildmay Radical Club, Islington, on Saturday afternoon, to consider "the difference in the price of gas in North as compared with South London." Mr. J. ROWLANDS occupied the chair; and a large number of delegates were present from all parts of North London.

The CHAIRMAN said they had been agitating for about six years for a reduction in the price of gas; and they were determined to go forward until they had the matter put right. The difference in the price of gas as between North and South London was 9½d. per 1000 cubic feet, which meant a sum of between £800,000 or £900,000 more taken out of the pockets of the consumers; those belonging to the working classes being chiefly affected. The Gaslight and Coke Company were penalizing industry to the extent mentioned, and there was no justification for continuing the high rates. The price the ordinary consumers had to pay for gas was 3s. 5d. per 1000 cubic feet; but to those who used penny-in-the-slot meters it was 4s. 2d.

Mr. JESSE ARGYLE moved the following resolution—"That this representative conference of gas consumers supplied by the Gaslight and Coke Company strongly protests against the exorbitant charge of 3s. 5d. and 4s. 2d. per 1000 cubic feet to the users of slot meters, in comparison with the charges of other Companies supplying the Metropolis, which is totally unjustifiable. The report of the Parliamentary Committee supports this statement: 'The Committee have very fully considered all the evidence submitted to them; and, after giving due weight to the reasons offered by the Gaslight and Coke Company in explanation of the higher price charged for their gas, they are of the opinion that the affairs of the Company have not been well managed.' This Conference is therefore of opinion that active steps should be taken to prevent the Company obtaining any further parliamentary powers until the management has been thoroughly reformed." He advocated resorting to a boycott of the use of gas as far as possible; and to the self-denying reduction of the use of gas in their houses.

Mr. A. M. TORRANCE seconded the motion. They ought, he said, to consider gas as one of the necessities of life; and no one was justified in taking a plundering profit out of the consumer. The cost of producing gas was the same on the south as it was on the north side of London; and it was a gross injustice that consumers in the northern district should be called upon to pay from 35 to 40 per cent. more than was paid on the south side of the river. The further difference made in the charge on slot meters was most unjust. On the shoulders of the working men and people of small income there was a burden placed which was altogether intolerable.

Another speaker having advocated that for six weeks they should abstain from the use of gas altogether, in order to show the Gas Company that the consumers were in earnest, the resolution was adopted.

Mr. W. GALLINGTON (Secretary of St. Luke's Peabody Buildings Gas Consumers' Protection League) moved that copies of the resolution should be forwarded to the Presidents of the Local Government Board and Board of Trade, the Chairman of the London County Council, the local representatives in Parliament, the Town Clerk of London, and the Clerks of all the Borough Councils north of the Thames. He mentioned that 400 of the consumers in St. Luke's Peabody Buildings had resolved to discontinue the use of the gas when directed so to do.

The motion was carried, as was also one to ask the Gas Company to receive a deputation.

MANCHESTER CORPORATION GAS SUPPLY.

The Allocation of Gas Profits.

The Special Meeting of the Manchester City Council, convened for Wednesday last, was, on account of the death of Her Majesty the Queen, adjourned by the Lord Mayor (the Right Hon. Thomas Briggs) without proceeding with any of the business on the *agenda*, which included the consideration of Alderman Gibson's proposal respecting gas profits; but we understand that this will be brought forward for discussion at a further special meeting to be held to-morrow.

Anticipating the possibility of the debate coming on, as arranged, he "Manchester Courier" on Thursday printed the following communication from a correspondent writing under the *nom de plume* of "More Light."

The gas question gives rise to endless controversy. Some people contend that gas consumers are under an obligation to the Corporation by being supplied with gas, and especially at the low prices supposed to have been charged. But I hold quite the opposite view, for the following, among other, reasons.

The Corporation have not charged low prices, and have made very handsome profits out of the consumers—far larger, indeed, than would be justified for the risk the citizens were running, and far larger than shareholders in limited companies would have been delighted with, especially as the supplying of the gas is a monopoly. Not that consumers should have been supplied by a limited company—far from it; but the profits prove that the Corporation have not been unremunerated. Then, again, some contend that calculations should be made, not on what the land, buildings, plant, &c., stand at in the books of the Gas Committee—namely, £1,026,456—but on the present estimated value of the works, of over £2,000,000. It is possible the land, buildings, plant, &c., are worth this sum; but if so, then it proves that too much has been taken out of the pockets of the gas consumers in the past, as works, &c., could only be written-down out of revenue, and this revenue could only be obtained from the high prices charged for the gas.

Therefore, gas consumers in the past have been paying too much for the benefit of posterity; and this having been done, the Corporation would surely not wish to commence *de novo*, and charge them on the present estimated value of works, of over £2,000,000, after they had already provided the money for writing-down. Further, some say the price of gas in Manchester compares favourably with prices in other towns. This is quite another question, and is dependent on very many different causes—locality, good management, good contracts for coal and cannel and residuals, low capital account, which may have been reduced in the way I have described above, and many other causes.

To illustrate this, during the ten years 1881 to 1890, the average figure at which the land, buildings, plant, &c., stood in the books was about £740,000, and the gross annual profits averaged about £127,000. These profits include an average sum of about £32,000 per annum charged for renewals against revenue, and for which there is no justification, seeing that an amount is annually charged for sinking fund—

Sinking fund	£22,000
To Corporation for interest on about £28,000—about 3¾ per cent.	£68,000 (about 9 per cent.)
To Corporation in aid of rates, £40,000—about 5 per cent.	

Now take 1900. The land, buildings, plant, &c., stood in the books at £1,026,456; and a gross profit was made of about £172,000, which includes about £23,000 charged for renewals against revenue, and which, as already contended, is unnecessary, as £36,000 was charged to sinking fund.

Sinking fund	£36,000
To Corporation for interest on about £38,000—about 3¾ per cent.	£90,000 (about 9 per cent.)
To Corporation in aid of rates, £52,000—about 5 per cent.	
Contingency account	£20,000

which was quite unnecessary, especially if land, buildings, plant, &c.,

be worth £2,cco,cco. The land alone is worth £3co,cco to £4co,cco; so that the risk of the citizens is *nil*.

The gas could have been sold at 3d. per 1coo cubic feet less, and still the shareholders in a limited company have received over 5 per cent. on their investment; so that the Corporation are charging about 3d. to 4d. per 1000 cubic feet more than a private company, which is not treating the consumers with consideration, and shows the Corporation are exacting too much.

Some say that nearly all the ratepayers are gas consumers; and then it amounts to the same thing whether the price of gas be low and rates high or *vice versâ*. But all ratepayers in Manchester do not use gas; and those who do cannot all use equal quantities or pay equal rates. If they did, it is wrong to raise money for rates by means of the gas monopoly; it is only another form of taxation. The most that should be done is to charge no more than a limited company could do the same services for, and shareholders in a limited company, well secured by a monopoly, would be glad of an annual dividend of 5 per cent., whereas the gas consumers, through the Corporation, have been contributing about 9 per cent., besides a considerable sum for still further writing-down the works.

The proposal of Alderman Gibson is, therefore, too generous. But no doubt he prefers to propose a resolution that gives fair grounds for the belief that it can be carried. But when all concerned consider the question more fully, they will agree that consumers are paying considerably too much to the Corporation for the risk the ratepayers are running. With gas for motive power and heating purposes, that can be produced by the Mond or producer gas process at very low figures, and with electricity and other sources of artificial light, it is very important that the Gas Committee should not be handicapped. On the contrary, every help should be given them to meet competition; and the lower the price, the more gas will be used for motive and heating purposes, which will help to solve the smoke nuisance problem.

PROXIMITY OF GAS AND WATER MAINS IN BELFAST.

The Law Committee of the Belfast City and District Water Commissioners recently presented the following report respecting the existing provisions in regard to the laying of gas-mains in proximity to water-mains: "Under the provisions of section 138 of the Belfast Water Act, 1840, the distance within which gas-mains are to be laid from water-mains is prescribed; and in the same section it is provided that the gas-mains shall not be laid under water-mains, unless in cases in which it shall be unavoidably necessary, and then only in the manner therein specified. The City Council contended that the distance prescribed by this section was too great; and, to avoid friction, the Commissioners agreed to amend the section in that respect. Accordingly a provision in the form agreed to by the Council and the Commissioners was inserted in the Belfast Water Act of 1899 (section 49), amending section 138 of the Belfast Water Act, 1840. The gas officials of the City Council have, however, construed this section as repealing section 138 of the Act of 1840, and insist that they are now entitled to lay their mains under the water-mains, and have already done so in at least one instance. It is possible that, if gas-mains are laid in this way, and there should be a leakage of gas, under certain circumstances very serious contamination may be caused to the water supplied to the citizens for domestic purposes. Your Solicitor wrote to the Town Clerk pointing this out, and as the Council took up the position that they were within their strict legal rights, he proposed to the Town Clerk to leave the interpretation of the sections before referred to to some eminent Counsel to be mutually agreed upon; and if the Council were right in their construction of the section, to pay the Counsel's fee. This proposal was described by the Town Clerk as a reasonable one; but later, when the matter was brought before the Gas Committee, he was instructed to refuse to agree to this course; and the last letter of your Solicitor to the Town Clerk, dated the 19th day of October, 1900, remains unanswered. Your Committee are advised that this is a matter of such importance to the health of the inhabitants that they cannot allow the provisions of the Act of Parliament to be disregarded; and they have accordingly instructed your Solicitor to take immediate proceedings to obtain a legal decision on the point. Your Committee regret that the Corporation—the public health authority of the city—should have had so little regard for the health of the citizens as to render this course necessary."

Mr. MITCHELL, in moving the adoption of the report, expressed the hope, now the Board had taken action, that they would not be compelled to go into the Law Courts. Before they reached that stage, he trusted the matter would be settled finally and satisfactorily, both in their own interest and in that of the ratepayers. They all served the same masters; and he did not think they should spend money in an expensive law suit.

Mr. MACAULEY, in seconding the motion, said there was one point that had always been in the minds of the members of the Water Board, and that was to carefully guard against the contamination of the water by gas. The last Act of Parliament dealing with the mains set forth that where a water-main crossed a gas-main it was to be laid at right angles; and this repeated the statement in the Act of 1840. The Commissioners were now simply asking that this should be carried out fairly in the interests of the ratepayers and themselves.

Mr. CORRY said the resolution was a most proper one; and he thought it would be well if the Commissioners and the Corporation would come to some amicable settlement. He did not think they were asking very much from the Corporation in requesting them to carry out the agreement that had been in existence for more than fifty years.

Mr. COATES drew the attention of the Board to a new aspect of the question. He said it was well known by practical men that all cast-iron pipes were porous; and if such pipes, one conveying gas and another water, were laid side by side—and, unfortunately, they were already too close in Belfast—the water was liable to become contaminated by the escape of gas. He thought the Commissioners did the wrong thing when they agreed to a distance of 2 feet instead of 4 feet.

The report was adopted.

ELECTRIC LIGHTING NOTES.

The Engineer of the Hull Corporation Electric Lighting Department has reported upon station extensions and improvements which will cost about £17,500.

At to-day's meeting of the Coventry City Council, a recommendation will be introduced that the electric lighting works should be extended at an estimated cost of £18,cco. This, coinciding with the new gas-works scheme, looks as though Coventry is in a healthy condition.

The City Council of Wells have been informed by the Board of Trade that they propose to at once rescind the Provisional Order granted for electric lighting. A special meeting of the Council was held on Monday last week, when the communication was referred to a Committee of the entire Council, who decided to apply to the Board to extend the time.

Six months after the time the people of Lowestoft expected to have electric lighting in their streets, the date has now been fixed when the Corporation Committee see their way to "switching on" the current for partial public lighting. Feb. 12 is to be the memorable day. It has been decided to give the undertaking a little "send off," but not on too elaborate a scale. It is just as well not to spend much in this way, as very shortly the town will be called upon to find principal, interest, and other little outgoings.

There must surely be something amiss with the public authorities of Middlesbrough. Excepting one or two of the minor departments, they are all in accord in not being in a hurry for the electric light in their departmental homes, although the Corporation are the purveyors of the current. The Streets Committee were meeting on Friday; and the Borough Engineer intimated to the members that he was about to get out tracings and estimates in connection with the installation of electric light in the Municipal Buildings. Whereupon Mr. Baker said there was no hurry. Then it was stated that neither the School Board nor the Guardians were anxious for the new light, but that it was desired in the police courts and offices and at the Free Library. Mr. Baker again chimed in with the remark that, if they had time in the Borough Engineer's department to prepare the plans, well and good; but there was no hurry at the present time. Alderman Archibald observed that, so far as the Committee-room was concerned, they did not sit at night, and did not want it there. This is a complete reversal of the usual order of things. It is generally the Corporation departments who desire and insist upon first consideration.

The chief topic to engage the attention of the Electricity Committee of the Manchester Corporation last Thursday was the delayed progress of the works at the Bloom Street extension of the Dickinson Street electricity station. It was announced that a letter had been received from Professor Kennedy stating that it would be a calamity to the city if the annexe was not completed and ready to take up its load in September. The Dickinson Street station, it was explained, will supply the current necessary for working the tramways on the three routes which it is hoped will be opened in the spring; and during the summer there will be little difficulty in the station meeting all demands. But it is absolutely necessary that additional power should be available ere the autumn begins. Otherwise the Committee will be compelled not only to refuse the applications of intending new customers, but also to cut off some of the present users of electric light. Under these circumstances, the Committee passed an emphatic resolution to spur on those who are engaged in the work at Bloom Street, and further decided that no more applications for extensive supplies of motive power shall be acceded to until the new premises are ready. The extension, when in full running, will add 14,coo-horse power to the 11,coo-horse power now possessed at Dickinson Street, bringing up the total horse power to 25,000.

Much excitement has been caused in Maidenhead lately over the electric light question. A meeting was held some weeks ago, but was adjourned without any decision being come to. Another subsequently took place, under the presidency of the Mayor (Mr. Wilton), when the proceedings were very lively, owing to the division of opinion as to the advisability of the Corporation undertaking the business. Mr. W. F. Good submitted a proposition that the Mayor should convey to the Town Council, on behalf of the meeting, its entire approval of the action hitherto taken by them with regard to the electric lighting of the borough, and expressing a desire that the necessary works should be at once proceeded with. Alderman C. W. Cox said that, if the ratepayers were willing to pay, he was quite content for them to have the electric light. "Do not imagine," he said, "that you are going to get this light and not pay for it." Mr. E. Gardner expressed the opinion that the town was not in a position to bear the additional burden of the Corporation conducting an electric light undertaking, the expense of which it would take them several years to clear off. Mr. E. K. Smart stated that his experience as a shareholder in fifteen electric light companies convinced him that any town with less than 18,000 inhabitants could not have the light without loss. On being put to the meeting, Mr. Good's proposition was declared lost. This caused an outburst of hooting and hissing, mingled with a few cheers. The Mayor was surrounded by Mr. Good's supporters, who claimed with some vehemence that he had made a mistake. It was clear that the majority of the audience considered that the Mayor was in error. The Mayor then put a resolution moved by Mr. Porter at the previous meeting—"That, in the opinion of this meeting, it is inadvisable to add £25,000 to the debt of this borough in order to introduce the electric light." This he also declared to have been lost. There were further protests; and finally the Mayor said he would undertake to inform the Town Council that Mr. Porter's resolution was put to the meeting and lost.

"Grumbling" has been defined by a well-known authority as "complaining without a cause." It certainly cannot be said to be applicable in the case of certain ratepayers of York, who have written to a local paper on the subject of the cost of the electric light. It appears that the Lighting Committee of the Corporation are wishful to meet these complaints by a reduction in the price of the current. A correspondent says it is much to be doubted if the proposed reduction—the price per unit for the "second hour"—will benefit many of those who find their accounts much higher than they had anticipated. He asks: "Is it not the reduction on the first hour that is needed?" He goes on to

point out that at present the man who replaces gas with electricity all over his premises, using (say) 50 lights, many of which will only occasionally be used—perhaps never in summer—obtains no rebatement until he has averaged 50 hours' burning of his lamps on every working day of the half year; while if he had only put in 15 lights where they were much used he would, though taking much less current, be securing the rebate. When it is considered that one of the chief conveniences claimed for the electric light is the ease by which it can be switched on and off for occasional lights, he thinks the present proposal of 7d. for the first hour and 2d. per hour after tends to the reduction of lamps, and therefore to the reduction of current used. If the Committee are in a position to make a reduction, he suggests that it is in the interest of both the Municipality and the private user that the present difference of 4d. per unit between the first and subsequent hours should be decreased rather than increased. Another correspondent confesses to being "grievously disappointed" with the very high charge which the Corporation have made for the electric light, which, he says, is altogether out of proportion to the cost which the consumers were led to believe would be made, and one which no ordinary consumer can afford to pay. One consumer regards the cost as being almost equal to the rent of his shop. Apart from this, the citizens are interested in the question of the cost of the electric lamps in the streets, each of which it is stated will saddle the ratepayers with no less than £20 a year. This correspondent has learnt on good authority that the electric lamps already fixed will actually cost the city close upon £500 a year more than the gas-lamps they displace. If this is so, the ratepayers, who will have to bear the extra expense, have a right to know it, so that they may judge as to the wisdom of increasing the number of these lamps. The question is put because, as the private consumers are asked to pay so much more than they expected, they naturally assume that the same high charge will be made for the public lighting. If so, is the difference in the illumination worth the extra cost? Some of the ratepayers venture to think it is not, especially those who have to bear a share of the expense without participating in the so-called benefit.

RATE OF WATER CONSUMPTION.

In previous issues of the "JOURNAL," reference has been made to the important investigation into the water supply of New York carried out by Mr. John R Freeman. One of the most interesting features of that inquiry was his endeavour to determine the hourly variation in the consumption of water. He plotted the results on two diagrams, which were given a short time ago in the "Engineering Record." One was constructed by first drawing a datum line on the curve of consumption for each city through the average of the points of minimum consumption, and then tracing the curves with this as a common zero-line The curves showed a very remarkable agreement; indicating that the quantity of water per head really employed in Manhattan and Brooklyn is not very different from that used in the completely metered cities of Fall River and Woonsocket. The New York observations were made from the 8th to the 14th of December, 1899; those in Brooklyn, from the 21st to the 24th of April, 1900; those in Fall River, from the 25th of April to the 2nd of May last year. Observations were made in Woonsocket concurrently with those in Fall River.

The method of measuring the variations of consumption in Manhattan was a simple one, because all the Croton water coming to the borough at the time of the investigation passed through the New Croton aqueduct, in which the rate of flow is very uniform. Three reservoirs in Central Park serve as an equalizer between the demands of the distribution system and the delivery of the aqueduct. The reservoirs usually rise about 3 inches in the night, while the draft is low, and fall to a similar extent under the heavier demand in the daytime. The method of investigation consisted simply in measuring with the greatest possible accuracy the rate of rise or fall in each hour of the 24. The observations in Brooklyn were conducted on the same principle, but were more elaborate because the water is pumped and not delivered by gravitation. In this case, measurements were made of the delivery of each of the main pumps and of the height of water in four reservoirs. In the case of Fall River and Woonsocket, the supply is pumped into steel tanks, and in each instance the troublesome question of reservoir leakage is thus eliminated. At Fall River, two of the three steel tanks were shut off, throwing all variations in level on the third, which was regularly watched. The pump counter and length of stroke were also observed. The pump slip was assumed to be 4 per cent., from a weir determination made some months previously. In Woonsocket, the pump does not run at night, and the change of level in the tanks is recorded automatically by means of a Winslow gauge.

In the course of some explanatory remarks upon his diagrams, Mr. Freeman states that the investigation was made because it afforded the best available means of estimating the proportion of New York's water supply actually used in comparison with the amount wasted. The results indicate that, out of 115 gallons per inhabitant per day, not more than 40 gallons are used. This is shown only from a single series of measurements, extending over two weeks, during which some unknown cause may have interfered with their accuracy; yet, after carefully studying the situation, he cannot find any reasonable ground for distrusting the determination, but, on the contrary, many facts to confirm it. Having first ascertained the varying quantity of water drawn from hour to hour by any convenient method of measurement, the inference as to the proportions used and wasted is based on the general experience that the real use of water in the hours after midnight, when most people are asleep, factories idle, and stores and offices empty, or more especially between 2 and 4 a.m., is very small in comparison with its employment during the hours of daylight; particularly after midnight on Sunday, when factory and house tanks have had ample time to become replenished under the higher pressure of that day. In most cities, the quantity of water drawn from the distribution pipes between the hours named may be fairly assumed to consist almost entirely of leakage and waste—a fact which is the basis of all work in waste prevention with the Deacon meter. This assumption has been proved correct in a large American commercial city by careful work with the meter system carried on for many years in Boston, and in numerous investigations into water waste made in other cities. But Mr. Freeman says it does not need meters, tests, or records to prove what everybody will admit—that in nineteen households out of twenty no water is drawn for use between 2 and 4 a.m., that not one-tenth as many men work by night as by day, and that not one office or store in a hundred is doing business at these hours. Common sense and every-day experience indicate that the real draft of water for use through faucets and stopcocks is not a tithe as great from 2 to 4 a.m. as from 7 a.m. to 4 p.m.

Mr. Freeman thinks the only questions that can cause doubt about the night consumption in New York in the first-named period being almost wholly waste are the following:—

1.—Under the conditions now existing, with tall buildings, feeble pressure, and some of the pipes small, and with the consequent large use of house tanks and pumps, may it not be that the refilling of these tanks is largely done at night? There are two main classes of tanks, those in domestic and those in commercial or manufacturing buildings; or they may be divided on another line—those filled by gravity and those filled by pumping. The gravity house-tanks in the high-service district are largely drawn down by day and refilled by night; but from a discussion of this question with leading plumbers, and from general considerations, it appears probable that most of these are refilled before midnight, or soon afterwards. The house-tanks filled by pumping are mainly replenished during the day. A canvass made of a large number of representative commercial, manufacturing, and other buildings, and a conference with building superintendents and engineers familiar with the current practice in New York, prove conclusively that the almost universal custom is to keep these tanks nearly full by pumping during the day, and to rarely, if ever, do any pumping after midnight or before 6 a.m. Many pumps were found to be fitted with automatic regulators which started the pump whenever the tank was drawn down.

2.—May there not be in New York special uses for large quantities of water at night in particular lines of industry? A visit to certain large power stations brings evidence that their hourly draft of water after midnight is only 20 per cent. of that by day. Among offices and commercial buildings, the main telegraph offices and the large newspaper offices were the principal large night users found; also certain breweries. But if the total use by all these establishments be added together and reduced to the rate per head of the population, the figure is so small as to have no weight in the present discussion. Mr. Freeman has been unable to learn of any special industries demanding uncommonly la ge quantities of water by night.

3.—May not the habit of late hours in New York increase the draft of water for use at night? While late hours are kept by many in New York, the great mass of the population are working people who rise early and retire early, and do not draw water for use between 2 and 4 a.m. The main uncertain element is the gravity house-tank; and for a possible late hour in refilling these, Mr. Freeman allows very liberally in calling the night use possibly 19 instead of 14 gallons per head.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

During this week people's minds have been diverted to so large an extent from the ordinary affairs of life by the death of our revered Sovereign, that my budget is smaller than usual.

Mr. John Learmont, Manager of the Milngavie Gas Company, has been a Gas Manager for 50 years, of which 42 have been spent in his present situation, and the previous 8 at Eaglesham. It has been resolved to recognize his private work and public services, as well as the regard in which he is held by the public, by making him a suitable presentation. With this view, a Committee has been appointed to receive subscriptions and arrange for the presentation. Mr. James M'Gilchrist, of Dumbarton, is appointed the official receiver of subscriptions.

A change has been made in Perth in the matter of the supply of gas-cookers Early in the summer of last year, Mr. W. B. M'Lusky, of Selkirk, was appointed Engineer and Manager to the Perth Gas Commissioners, in succession to Mr. A. Wilson, now at Bradford. Shortly after his appointment, Mr. M'Lusky, upon instructions, submitted a report upon the arrangements which existed as to the supply of gas cookers and heaters. From this report, it appeared that the Gas Commissioners, following a recommendation by Mr. Wilson (who had been asked to report as to the respective merits of the Main fires and those of the Carron Company, and who had stated that the former were the more economical of the two), had adopted the Main fires, and had asked Messrs. Main to appoint an agent in Perth for the supply of their goods. Mr. John Macpherson was accordingly appointed, and has acted in that capacity since. The Commissioners have invested about £4000 in Main apparatus. Mr. M'Lusky reported that the arrangement was certainly without a parallel in the gas-stove trade of the country today; and he recommended that offers should be invited from competitive makers. He considered that the present rent charge of 10 per cent. on the net price was a fair one, as it paid off the cost of the stove in ten years, and yielded the Commission 7½ per cent. on the sum capitalized; but it left nothing for the capital outlay in fixing the stove. He suggested the adoption of the cash purchase and cash hire schemes which were in use in Selkirk. Under these, the Commissioners would purchase a gas-stove of £5 list price for £3 10s., and would sell it to the consumer for £5, thus making 20 per cent. The Gas Department would thus earn 15 per cent. upon a cash transaction, and be freed from capital outlay. In the case of a hire-purchase, 3½ per cent. would be added for a three years' term, and four per cent. for a five years' term. Working upon this system, they had, in Selkirk, 600 cookers in use, with a capital outlay of only £278; and all the rents received were applied in redemption of this sum. Upon receiving the report, the Commissioners requested their Treasurer (Mr. C. J. Lindsay) to report upon the financial aspect of Mr. M'Lusky's proposals. Mr. Lindsay stated that the Commissioners, when they began to hire-out stoves, had no power to borrow money for investing in them, but resolved to apply the balance standing at the credit of the contingency and depreciation funds for the purpose. They were a little dubious of the department paying its way. In three years, how-

ever, there was an increased output of gas amounting to 25½ million cubic feet; and in 1897 powers were obtained to invest funds in gas stoves and cookers. The Commissioners at the time considered that, by confining themselves to one make of stove, they were saved trouble in suiting hirers; and they adopted the Main goods. Mr. Macpherson, as the agent of Messrs. Main, opened show-rooms in Perth; and, keeping the business well before the public, he had been chiefly instrumental in making the gas-stove business in the town a success. On Sept. 30 last there were on hire 1066 gas-stoves, 96 gas-fires, 21 water-heaters, 11 condensing stoves, and 700 gas-rings, irons, &c. The sale of gas during the six years ending April 30 last increased by 60 million cubic feet, which was mainly attributable to the use of gas stoves and cookers. When the Commissioners arranged to acquire these goods through an agent, it was distinctly understood that they were to have one-half of the trade discount of 6s. 8d. per pound, but were to have no responsibility whatever for breakages. This arrangement the then Convener of the Works Committee (ex-Bailie Cuthbert) considered laid the heavy end of the log on the shoulders of the agent. The amount of commission paid by the Commissioners to Mr. Macpherson during the six years amounted to £1104, equal to over £14 per month. A newspaper man interviewed Mr. Macpherson, who complained that Mr. M'Lusky should, within thirty days of his arrival in Perth, have prepared a report in which he assumed that he was in a position to deal exhaustively with the gas-stove trade in a town where he was a complete stranger. He challenged Mr. M'Lusky to mention a place in Scotland where cookers were fixed at so small a cost as in Perth, or where there was so large a percentage of stoves and other appliances earning money. For the first few years, he had to work at starvation wages; and his net income to the present time was little more than £100 per annum. He was confident that, but for the way in which he had worked up the gas-stove business, leading to an increased consumption of gas by 60 million cubic feet in six years, the price, instead of being 3s. 6d., would now be 4s. 2d. per 1000 cubic feet. He felt aggrieved that, when the Convener (Mr. Watson) asked him to make the year a record one, and he had done so, the next he should hear was that Mr. Watson should bring forward a motion to dispense with him. The Commissioners on Monday adopted the recommendations of Mr. M'Lusky. It is possible to feel sympathy for Mr. Macpherson; but he entered into the business with his eyes open—a business in which he was to have a monopoly. Monopolies are not favoured in these days; and this circumstance should have led him to look with dubiety upon a proposal to put him in that position, because, in our municipal work-a-day world, men come and go, and an arrangement which is approved of by one set this year, may be disapproved of by their successors next year. It is therefore all the more essential that new business schemes should be upon the most solid and enduring lines possible.

Intimation has been received in Paisley that the Provisional Order which is about to be promoted in the name of the Gas Department of the burgh, to obtain powers to borrow a further sum of £25,000 for the electric lighting installation, has been approved by the Scottish Office, on the terms asked, and that a local inquiry will not be necessary.

At the meeting of the Falkirk Town Council on Monday, objection was taken to the minute of the meeting of the 11th inst., at which it was resolved to adopt the Thornhill site for the new gas-works. Bailie Bogle thought the subject had been rushed upon the Council, and that they should have had Mr. Gillespie's report circulated among the members, so that they could have applied their minds to it before they were called upon to decide. This seems to be a reasonable request; and if the subject was rushed, it is a pity it should have been so. On the merits, Bailie Bogle pointed out that Mr. Gillespie's only objection to the site at Parkhouse is that it is too small; but, he argued, if 1 acre of land be sufficient just now, 5½ acres should suffice for a long time. He went on to say that they have £14,000 already invested in the Parkhouse land, and that if they erect a gas-works on the Thornhill ground the cost will be so great that they cannot expect to have cheap gas in Falkirk for a long time. In this connection, he referred to the possibility of the Larbert and Stenhousemuir districts hiving off and erecting a gas-works of their own. Mr. Stevenson supported Bailie Bogle; and, after some discussion, Bailie Russell gave notice of a motion to the effect that all information in connection with the sites, probable cost, railway facilities, and plans, be laid before the members of the Council as early as possible. The subject is thus not much further forward. If it be the case that the Larbert and Stenhousemuir districts are contemplating the erection of gas-works of their own, which is certainly within their right, the whole subject of the building of new-works for Falkirk would undergo a change which could not be overlooked. The question would come to be whether the Corporation of Falkirk could expect to sell gas at a cheaper rate than the Larbert and Stenhousemuir people. If they could, then it would be wisdom to proceed with the Thornhill site; but if they could not, then, in view of the possibility of losing the supply in those places, it would be worth considering whether the smaller site would not be sufficient. This is just one of the points upon which the further information which is to be called for should throw light. It was mentioned that there is at present a leakage of 25 per cent. in Falkirk, and that a great saving could be effected upon this score. The figure is an exaggerated one; but, at the same time, the unaccounted-for gas in Falkirk is higher than it should be, and it ought to be possible to make the works meet a greater consumption than at present. But this, again, should be one of the points dealt with in the further information to be asked for.

Expenditure of the London County Council.—In the local taxation returns for 1898-9, which have lately been issued, the expenditure of the London County Council in connection with gas and meter testing is shown to have amounted in that year to £9099, which was balanced by £6629 received as fees and £213 recovered from the Gas Companies as expenses. On water supply the expenditure was £6746, of which £1911 was for promoting Bills, £3429 for evidence, &c., before the Royal Commission, and £1393 in connection with the Metropolis Water Act of 1897.

CARBURETTED WATER-GAS APPARATUS

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SALTLEY WORKS, BIRMINGHAM	2,000,000	YORK	750,000
COLCHESTER	300,000	ROCHESTER	500,000
BIRKENHEAD	2,250,000	KINGSTON, ONT.	300,000
SWINDON (New Swindon Gas Co.)	120,000	CRYSTAL PALACE DISTRICT	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	DULUTH, MINN.	300,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000 000	CATERHAM	150,000
HALIFAX	1,000,000	LEICESTER	2,000,000
TORONTO	250,000	ENSCHEDE (HOLLAND)	150,000
OTTAWA	250,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
LINDSAY (Remodelled)	125,000	BURNLEY	1,500,000
MONTREAL	500,000	KINGSTON-ON-THAMES	1,750,000
TORONTO (Second Contract; Remodelled)	2,000,000	ACCRINGTON	500,000
BELLEVILLE	250,000	TONBRIDGE	300,000
OTTAWA (Second Contract)	250,000	STREATFORD	600,000
BRANTFORD (Remodelled)	200,000	OLDBURY	300,000
ST. CATHERINES (Remodelled)	250,000	TODMORDEN	500,000
KINGSTON, PA.	125,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
PETERBOROUGH, ONT.	250,000	YORK (Second Contract)	750,000
WILKESBARRE, PA.	750,000	ROCHESTER (Second Contract)	600,000
ST. CATHERINES (Second Contract)	250,000	NEWPORT (MON.)	250,000
BUFFALO, N.Y.	2,000,000	TOKIO, JAPAN	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 26.

Sulphate of Ammonia.—There has been a quiet market throughout the week, and values have been barely maintained; the closing quotations being £10 16s. 3d. per ton f.o.b. Hull, £10 18s. 9d. f.o.b. Liverpool, and £11 1s. 3d. f.o.b. Leith. Urgent orders having for the most part been covered, there has been a disposition on the part of buyers to hang back for the chance of easier prices; but, on the other hand, the large makes being fully sold for the month, available supplies have not been too abundant. The interest in the forward position has resulted in considerable sales in London for February-April delivery, at £11 2s. 6d. per ton, Beckton terms. For the same period, Scotch makers are holding for £11 7s. 6d. per ton, f.o.b. Leith, ordinary terms; but, so far, this price is not reported paid.

Nitrate of Soda is steady at 8s. 4½d. per cwt. for ordinary, and 8s. 7½d. for refined quality. The season can scarcely be said to have yet commenced, and buyers show no eagerness to anticipate their requirements.

LONDON, *Jan.* 26.

Tar Products.—There is no improvement in this market. Pitch moves steadily off on old contracts; but buyers are now offering less money for forward business. It is stated that there will be a very considerable shortage of tar made this season owing to the mild weather. A fair business is doing in naphthas, but prices are not good. Creosote and tar oils continue unsaleable, excepting for fuel purposes. Carbolic is steady. Anthracene only has a nominal value; but tar salts are readily saleable at former rates.

Market values for the week are: Tar, 13s. 6d. to 17s. 6d. Pitch, east coast, 32s.; west coast, 29s. Benzol, 90's, 10d. to 1s., according to position; 50's, 11d. Toluol, 1s. 1½d. Crude naphtha, 4½d. Heavy naphtha, 1s. Creosote, 1d. Heavy oils, 2d. Carbolic acid, 60's, 2s. 7d. Naphthalene, 90s.; Salts, 60s. Anthracene, nominal, "A," 3d.; "B," 2d.

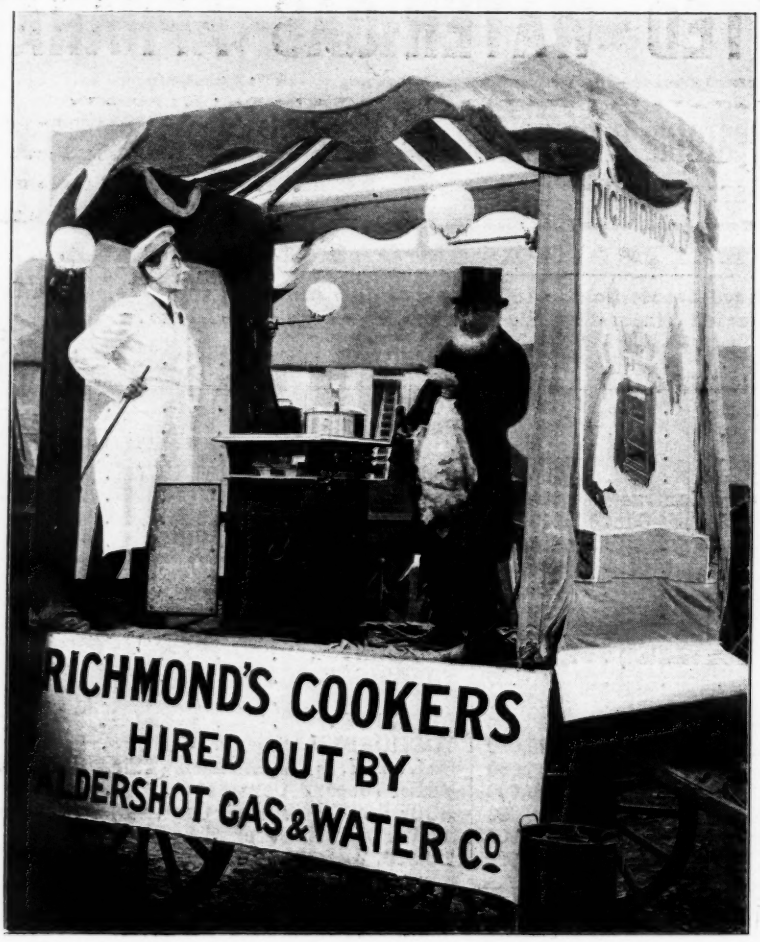
Sulphate of Ammonia.—This market shows signs of weakness owing to a very determined effort to "bear" prices. Makers, in most instances, are well sold, and are indifferent to the market movements; but a considerable quantity of sulphate is being chopped and changed about in a remarkable manner by middlemen. For forward delivery, buyers will pay more money than for spot; the average value to-day being about £11 per ton, less 3½ per cent. at all ports.

A recent number of the "Ironmonger" contained an illustrated description of an improved form of gas-oven, specially designed for confectioners' use, made by Messrs. Mabbott and Co., of Manchester. The makers claim that with this appliance there is no possibility of the gas-flame or any of the products of combustion entering the baking chamber. The gas is turned on by taps at the front, and lighted through holes; and the heat, which is carried in specially arranged flues up the sides and across the top, where it escapes, is equally distributed all round the oven.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The situation so far as round coal is concerned remains generally fairly strong; but in the lower qualities of fuel there are indications of prices breaking up, which, although only at present in isolated cases, tends to show that the outlook is not altogether satisfactory from the coalowners' point of view. The better qualities of round coal, though not in pressing request, are still moving away freely for house-fire purposes; and collieries have really no surplus supplies on their hands. Prices are steady at about 16s. 6d. to 17s. 6d. per ton at the pit for best Wigan Arley, 15s. to 16s. for Pemberton four-feet and seconds Arley, and 13s. 6d. to 14s. for common house coal. Common round coals are perhaps becoming more difficult to move, partly owing to decreasing common house-fire requirements, and partly to a general quietness in the shipping trade; while the depression throughout the iron trade is still further restricting requirements for iron-making purposes. In some cases, steam and forge qualities are beginning to hang at collieries, but not as yet in sufficient quantity to at all appreciably weaken prices, which, at the pit, remain at about 12s. to 12s. 6d. per ton, and for delivery at the ports on the Mersey at about 14s. 6d. to 15s. The chief competition is in engine classes of fuel, plentiful supplies of which are obtainable from Derbyshire, Staffordshire, and in some instances from Yorkshire, at much below the quotations of local collieries; and in odd cases even Lancashire coalowners are quoting considerably under the minimum basis rates for inferior qualities of slack rather than allow business to pass into other hands. For the best qualities of slack, 10s. to 10s. 6d. per ton may be taken as about average pit prices, with 9s. 6d. to 10s. for medium sorts; but some of the inferior descriptions of Lancashire slack have in special cases been sold as low as 8s. The suggested pool in engine fuel on the part of the Lancashire colliery owners, as a retaliatory measure against the competition of the Yorkshire collieries, to which reference was made last week, is still talked of; but so far nothing definite has been done. Wages questions are likely to be a source of some trouble, as, notwithstanding the agreed further advance of 5 per cent. which comes into operation next month, the miners are making various indirect claims for increased remuneration; and at one of the large Manchester collieries, there is a strike threatened by the men because the owners are not prepared to concede all that is demanded. With the high rate of wages and the attitude assumed by the miners, both as regards the output and remuneration, the coal trade has undoubtedly a serious difficulty to face; and how matters will progress in the immediate future, it is scarcely possible to anticipate in any really definite manner. For coke, although nominally Lancashire quotations are unchanged for either furnace or foundry qualities, the considerable giving way in other coke-manufacturing districts must undoubtedly weaken the position here—especially as regards furnace qualities, requirements for which have been largely curtailed owing to numerous pig-iron furnaces being put out of blast.



ALDERSHOT WAR CARNIVAL.

PRIZE TRADE CAR.

Northern Coal Trade.—The coal trade of this district has been irregularly dull; but on the whole prices are lower than they were, the chief cause being that less fuel is being used in the iron trade. Best Northumbrian steam coals are in smaller demand; but the output of the collieries is fairly well taken up, and the price is about 12s. 3d. per ton f.o.b. Steam smalls are from 6s. to 6s. 3d. per ton, and are in moderate inquiry only. In the gas coal trade, the settlement of some of the contracts for export is beginning better to define values. That for Copenhagen, delivered over the spring and summer, is again placed with Durham collieries; and the price is about 17s. 9d. per ton, c.i.f. Last year, the average rate of freight was about 6s. 9d. per ton; but it is expected that freights will be lower now, so that the price of the coal would be correspondingly higher. In the coke trade, the tendency is weak. For export coke, about £1 per ton is now the f.o.b. quotation; and for blast-furnace coke, about 15s. 6d. per ton. Normal values are thus being returned to. For gas coke, 17s. per ton f.o.b. has this week been quoted by one of the chief gas companies of the North; but lower prices are current—down to 15s. per ton—on the Newcastle Exchange. The production of gas coke, however, is now decreasing appreciably; and this may tend in some degree to steady prices, which have fallen of late with those for ordinary coke.

Scotch Coal Trade.—There is a large volume of business doing; but the prospect is doubtful, both sides being in a hesitating mood. The prices quoted are: Main 10s. 6d. to 10s. 9d. per ton f.o.b. Glasgow, ell 11s. 6d. to 12s. 6d., and splint 12s. to 12s. 6d. The shipments for the week amounted to 196,247 tons—an increase of 71,691 tons upon the previous week, but a decrease of 4074 tons upon the corresponding week of last year. For the year to date, the total shipments have been 411,949 tons—an increase of 10,735 tons.

Walker and Wallsend Gas Company's Electricity Undertaking.—The Walker and Wallsend Gas Company some time ago promoted a Bill in Parliament to enable them to supply electricity, for lighting and motive power, in their district; and this Bill was carried in the face of a good deal of opposition. The Company have set up a power station at Neptune Bank, Walker; and, by a working agreement which they have with the Newcastle Electric Supply Company, this power station, combined with the one at Pandon Dene, will be able to supply power in bulk to the whole of the important industrial district on the north bank of the River Tyne, east of Newcastle. The station was at first built for two sets of continuous plant for driving small motors for lighting, and three sets of large engines, each developing some 1400-horse power. Already a portion of the plant is in operation, and is supplying electricity for both these purposes to sundry commercial works and establishments in the district. The original limits of the station are even now being extended to admit four sets of engines; and a still more extensive power station is about to be laid down at the east end of Wallsend. The station will have sufficient reserve power to run electric trams between Newcastle and North Shields. A Bill is already drafted to obtain parliamentary sanction.

Burgess Hill and District Water Supply.—At the last meeting of the Chailey District Council, a communication was read from the Burgess Hill Urban District Council in reference to the Bill of the Burgess Hill Water Company. It referred to the proposed action of the Cuckfield Rural Council to obtain a purchase clause in the Bill, and asked if the Chailey Council would be disposed to join the Local Authorities in forming a Water Board. After some discussion, the Council decided to give Burgess Hill their moral support, to prevent the Cuckfield Council obtaining the insertion of a purchase clause, which would give Cuckfield the power of obtaining the sole control of the water supply of the Company. A Committee was also formed to go into the question of a water supply for the district, with a view to the Chailey Council supplying their own place; and a resolution was passed giving the Committee power to engage expert advice for the purpose of coming to a determination.

The Competition of Gas and Electricity for the Public Lighting of Woking.—The question of public lighting is now being agitated at Woking; and from the statements that have appeared in the local papers, it would seem that the tenders submitted by the Electric Light Company and the Gas Company are not fully understood. The Woking District Gas Company have therefore (through their Secretary, Mr. R. Dennett Holroyd) submitted the following details of their version of the position of the question. According to the local Press of Jan. 18 last, the present contract with the Electric Light Company for lighting 123 25-candle power public lamps amounts to £598 14s. per annum, or at the rate of £4 17s. 4d. per lamp per annum. The Electric Light Company now tender for a renewed contract for lighting the same 123 lamps, and to put three glow lamps on 20 standards and two glow lamps on the others for £396 13s. 6d., which works out at £3 4s. 6d. each per annum. Under the present contract, assuming all the lamps to be single 25-candle power lamps, it would represent a total illuminating power of 3075 candles. Under the proposed new conditions, the total maximum candle power would be 6650, or more than double. Some of the present lamps, however, are supplied with double burners, so that the proposed increase in the illuminating power may not be so great as thus shown. The Gas Company offer to convert the 123 existing electric light columns for use as incandescent gas-lamps, and to light, clean, repair, and renew the mantles—including interest on the outlay by the Company for the existing electric light standards, and their conversion for use with gas—at the rate of £2 13s. per lamp per annum, with burners having an illuminating power of 60 to 75 candles; or with burners having an illuminating power of 80 to 100 candles, at the option of the District Council, at the rate of £3 0s. 9d. per lamp. For the first case, this works out at a total of £325 19s. per annum; and in the second, at £373 12s. 3d. It will be seen that both these totals are lower than the electric light tender; while the maximum illuminating power in one case would be a total of 9225, and in the other 12,300 candles—showing an excess of illuminating power over the electric light of 38 per cent. and 85 per cent. respectively. It will be interesting to see what the Council will do in face of this clear exposition of the state of the matter.

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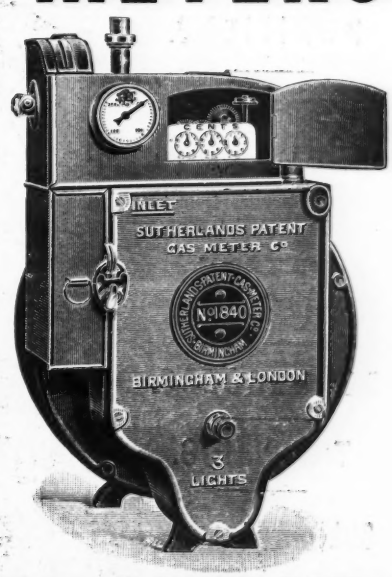

THE SUTHERLAND GAS-METER COMPANY

ESSEX WORKS, BIRMINGHAM.

Mond Gas Bill.—The Rowley District Council have joined the opposition to this Bill for the purpose of securing the insertion of clauses for the protection of highways.

Gas Workers' Union and the Trades Federation.—Our readers are aware that for some little time the relations of the Gas Workers' Union with the Trades Federation have been in a state of tension; and during the past three weeks a ballot of the members has been taken on the question whether the Union shall secede from the Federation. The result of the ballot was made known at a meeting held at the head-quarters in London on Sunday, but was not announced to the public. The deliberations lasted for nearly nine hours. A prolonged debate took place as to whether the result of the ballot should be acted upon; and it was eventually decided that a general conference should be called to consider the whole matter within the next three months.

Richmond's Travellers in Conference.—Messrs. Richmond and Co., Limited, held their bi-annual conference of travellers and heads of departments, at the Bournemouth show-rooms last Thursday, Friday, and Saturday. We have had an opportunity of glancing at the seventy odd items on the *agenda*, and are struck with the amount of really useful and educational questions which came up for discussion. As examples, the advertising arrangements for the year were considered, and new schemes decided upon. Improvements in gas cookers and fires were suggested by the "gentlemen of commerce," the Works Managers present stated how far these could be carried out, and a decision was arrived at there and then. Perhaps the most important decision come to was that of offering substantial prizes to the travellers and branch managers for (1) the largest percentage increase in business, (2) the largest increase in turnover, and (3) the opening up of new accounts. In the aggregate, Messrs. Richmond and Co. anticipate that this system of prize-giving will cost them at least £250 per annum. The proceedings lasted the full three days, and terminated late on Saturday evening.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, on Monday last week, Mr. Alfred Richards sold £4500 additional stock of the Colney Hatch Gas Company, carrying 7 per cent. dividend, at prices ranging from £132 10s. to £134 per £100 of stock; the total amount of the purchase-money received being £5985 10s. On the same occasion, he sold 500 ordinary £10 shares in the North Middlesex Gas Company—ranking, in consequence of a reduction made by the Company in the price of gas as from the 1st inst., for the full dividend of 7 per cent.—at from £13 2s. 6d. to £14 per share. On Tuesday, Mr. Richards sold £11,916 of perpetual 4 per cent. debenture stock of the West Ham Gas Company, at from £103 to £104 per cent. Last Thursday, Messrs. Sudlow Herrick and Sons sold locally £10,000 of new consolidated ordinary stock in the Kingston-on-Thames Gas Company. The prices obtained fluctuated between £120 and £125 per cent.; and the total realized was £12,041 2s. 6d. At Newmarket on Tuesday, among a number of shares sold by auction were nine £10 ones in the Bury St. Edmunds Gas Company, which realized £16 per share, and ten £10 shares in the Newmarket Water Company, which produced in part £17 10s. and £18 each.

Water-Meters for St. Louis.—Mr. E. Flad, one of the Water Commissioners of St. Louis, recently recommended the general use of water-meters in the city. In a paper read before the Commercial Club, he stated his recommendation as follows: "With the universal introduction of meters, the rates could be reduced without interfering with the net income of the works. Each customer should be charged a fixed minimum rate, which could be somewhat less than—perhaps three-fourths of—the schedule rates. The minimum rate would allow for each residence a fixed quantity of water, which would be ample to allow of a liberal use of same. All excess above such fixed quantity would be paid for at meter rates."

Keighley Arbitration Case.—At the Hotel Metropole, Leeds, last Wednesday, Mr. Thomas Newbigging concluded his hearing of the arbitration proceedings between Messrs. Newton, Chambers, and Co., of Sheffield, and the Keighley Corporation, arising out of a dispute regarding some mechanical coke-conveyors supplied by the firm to the Corporation Gas Department. Except for a brief period occupied in the recalling of two witnesses, the day was spent in speeches; Mr. W. J. Waugh summing up on behalf of the Corporation, and Mr. Parker Rhodes replying on behalf of the firm. At the close, the Arbitrator said he would not be long in making his award after he had received the full transcript of the shorthand notes of these somewhat protracted proceedings.

Claim against the New River Company.—At the Surveyors' Institution, Westminster, on Monday last week, Mr. G. A. Wilkinson sat as Arbitrator to decide the value of land which the New River Company have acquired for the extension of their works. Mr. Freeman, Q.C., and Mr. Maurice Hill appeared for the claimants; and Mr. E. Boyle, Q.C., represented the Company. The lands in question are situated at Greenford, near Ealing, on the banks of the River Brent. The claimants contended that the land, being within ten miles of London, should be considered as building land. The quantity acquired for the construction of works was about 2¾ acres. Mr. E. Millard estimated the value of the land at £200 an acre—a total of £432 10s., or, with the usual 10 per cent. for compulsory sale, £475 10s. To this he added £50 for an aqueduct which is being constructed, and £2034 10s. for the severance involved by this and the consequential damage to the estate, at the rate of £40 per acre. Other items made up the total valuation to £2710. Mr. D. Watney estimated the value of the land at £300 per acre; and his total valuation was £2048. Mr. C. Jones, Surveyor of the Ealing District Council, agreed with Mr. Millard's valuation. In his view, the Company's aqueduct would entail an extra cost of £300 in the drainage works which would be required in developing the estate for building. For the Company, Mr. Boyle contended that there was no building value attached to the land. The Company had agreed to give access across it, and therefore there could be no claim for severance. The land was low-lying, and before the cleansing of the River Brent by the Middlesex County Council had been subject to floods. He called Mr. E. Tewson, Mr. E. Fuller, and Mr. Joshua Baker, whose valuation was £384. The Arbitrator reserved his decision.

Telegraphic: "Fortress, Donnington, Salop."

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PURIFIERS.

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SULPHATE OF AMMONIA PLANTS.

WASHERS.

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HYDRAULIC MAIN VALVES.

RETORT-MOUTHPIECES.

SLIDE-VALVES, TAR-BURNERS, SIEVES.

GASHOLDERS.

A Town in Darkness.—Owing to the Gas Company and the Parish Council of Wainfleet, near Skegness, not being able to agree as to the price of gas for the street-lamps, the town is in darkness at night. The Council offer to pay for the gas by meter; but the Company hold out for a definite payment per lamp.

Manchester Water Supply.—The statistics relating to the supply of water within the area of the Manchester Water Committee show that there was a slight decrease in the consumption last year. The average quantity supplied per day was: From Longdendale, 24,202,660 gallons; from Thirlmere, 8,092,298 gallons—total, 32,294,958 gallons. The greatest consumption took place in July, when the average daily quantity supplied was 34,184,685 gallons; and the lowest in December, when the average was 30,722,708 gallons. The maximum quantity drawn from Longdendale was in July, when the daily supply was 26,160,753 gallons; the maximum from Thirlmere in December, when the daily quantity was 8,594,771 gallons.

Reservoir Rating.—At the meeting of the Sunbury District Council on Monday last week, Mr. Scott made a report with regard to what had been done by the Association for the Equitable Rating of Reservoirs, of which he is the Hon. Secretary. Applications had been sent to all the Unions in England and Wales for particulars with regard to the reservoirs in their areas, and the returns had been tabulated. At the time of the General Election, a letter was sent to the candidates, asking them, if they were returned to Parliament, whether they would support legislation for the alteration of the present law relating to the rating of reservoirs. As many as 252 favourable replies were received from candidates, and 105 of those, representing all parties, had been returned to Parliament. The time had now arrived when they required the "sinews of war." There was a pressing need for money, and he thought a Committee should be appointed to raise a fund locally, which would enable him, when the Association met, to ask the delegates to do likewise in the districts they represented. The suggestion was approved, and a Committee appointed, with power to add to their number.

Storage at the Driffield Gas-Works.—The Driffield District Council have lately had experience which has convinced them that they have a "weak spot" in their gas plant, and it is in connection with the storage. It is only equal to 65,000 cubic feet, which is practically half-a-day's supply. On one occasion they had to restrict the lighting of the public lamps (numbering 156) to 25. Then, although the consumption of gas is increasing, the Gas Committee have refrained from pushing the use of cookers and slot-meters, in consequence of inability to store sufficient gas During the two years the undertaking has been under the management of the Council, a profit of £2000 has been made. Yet there has been delay in making suitable provision for doing a larger business. However, the Council have now listened to the advice of their Engineer, and plans for a new holder are to be prepared, and an application made for the necessary loan.

Progress of the New Nottingham Water Scheme.—According to the "Nottingham Express," about 18 of the 20 miles of mains that are required to bring the new water supply obtained at Broughton to Nottingham have now been laid. The work has been proceeding from both ends simultaneously; and the two working parties are now approaching each other in the vicinity of Farnsfield. The pipe-laying is expected to occupy another month or two. But even then it is not thought that they will be ready to pump till May. The well at Broughton is about 150 feet deep, beyond which boreholes go down about another 100 feet into the sandstone rock. All this is completed; and the engine-house is being pushed on with. For the present the intention is to pump the Broughton water into the reservoir at Red Hill, so that the water from this source can be immediately rendered available in Nottingham. But it is intended eventually to build a new reservoir.

In the article on the proposed improvements at the Walsall Gas-Works which appeared in the "JOURNAL" last week (p. 224), it should have been stated that the contract for half the fire-clay goods required had been obtained by Messrs. Mobberley and Bayley.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; no necessarily for publication, but as a proof of good faith.

TERMS OF SUBSCRIPTION to the "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance. If credit is taken, the charge is 25s. a year.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1901, are reminded that this should be done at once.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegraphic Address: "GASKING, LONDON." Telephone Number: Holborn 121.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
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LONDON, E.C.

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Resists 4500° Fahr. Best for use in GAS-WORKS.

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JOHN RILEY & SONS, Chemical Manu-facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

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PATENTS FOR INVENTIONS.
Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
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SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers.
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SADLER & CO., Ltd., Middlesbrough,
Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
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PORTER & CO., Gowts Bridge Works,
LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."
[For Illustrated Advertisement, see Jan. 1, p. 54.]

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are pre-pared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
19, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "LUMINOSITY."

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

BLACKSMITH and Fitter (age 26), wants Situation. Can work Water-Gas Plant. Used to Engine and Boilers.
A. B., 3, Station Villas, Mill Hill, HENDON.

ADVERTISER (age 31, and Married) seeks re-engagement as MANAGER of Gas-Works, making from 10 to 20 million cubic feet per annum. Highest References.
Address No. 8634, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

OXIDE OF IRON OF FINEST QUALITY.

BALE'S Special Fire Cement should be used to keep Retorts, Furnaces, &c., in good repair during the heavy Winter Work.
Send for full Particulars to
BALE & CO., 120 & 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."
Telephone "277 HOLBORN."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

WANTED, a Gas-Works Fitter, com-petent to lay Mains and Services, fix Slot Installations and Stoves. Wages 30s. per week.
Apply, with References, to the MANAGER, Gas-Works, DORKING.

WANTED, a good Main and Service LAYER. One accustomed to Meter and Stove Fixing (Iron and Compo.). Constant employment.
Applicants to state, by letter, Age and Wages required, and enclose recent Testimonial, to No. 3635, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN wanted for En-gineers' Works. Must be accurate and experienced in the details of General Engineering, and a knowledge of the construction of Gas-Works Plant is desirable.
Apply, stating Age, Qualifications, and Salary required, to WEST'S GAS IMPROVEMENT COMPANY, LTD., Albion Iron-Works, Miles Platting, MANCHESTER.

THE Bristol Water Works Company re-quire an ASSISTANT SECRETARY (whose age must not exceed 35 Years) of good executive Ability and Experience. Salary commencing at £300 a year.
Applications, endorsed "Assistant Secretaryship," accompanied by *copies* of Testimonials, should be made in writing, not later than the 8th of February next, to the undersigned, and should state Age, Experience, General Qualifications, and present and past Employment.
Canvassing not permitted.
By order,
(Signed) ALFRED J. ALEXANDER,
Secretary and General Manager.
Small Street, Bristol.

URBAN DISTRICT OF NEWTON-IN-MAKERFIELD.

GAS AND WATER ENGINEER.

THE Council for the above-named District invite APPLICATIONS for the position of GAS AND WATER ENGINEER.

Candidates must be not less than 24 nor more than 40 Years of Age, and be competent to prepare all Plans and Drawings, and to supervise the erection of additional Buildings, Machinery, and Plant at the Water-Pumping Station and Gas-Works as may be required from time to time. He must also have a thorough practical knowledge of the most modern Systems and Appliances for raising and distributing Water, and the manufacture and distribution of Gas, and be able to carry out the laying of such additional Gas and Water Mains as the Council may direct.

The Engineer appointed will be required to devote the whole of his time to the duties of the Office.

Salary commencing at £150 per annum, rising to a maximum of £300 per annum.

The appointment will be subject to Three Months' Notice on either side.

Applications, accompanied by *copies* of not more than three Testimonials of recent date (which will not be returned), to be forwarded to the undersigned not later than Saturday, the 9th of February next, endorsed "Gas and Water Engineer."

Canvassing the Members of the Council, either directly or indirectly, will be deemed a disqualification.

C. COLE,
Clerk to the Council.

Town Hall, Earlestown,
Lancs., Jan. 21, 1901.

NEWTON-IN-MAKERFIELD URBAN DISTRICT COUNCIL.

GAS AND WATER WORKS CLERK.

THE above-named Council invite Applications for the appointment of a CLERK competent to keep the Books and Accounts connected with their Gas and Water Works.

It is desirable that applicants for the position should possess a good, practical knowledge of Book-keeping and the Clerical Work appertaining to such Undertakings as Gas and Water, and be able to take charge of the Stores of all Departments of the Council.

The Candidate appointed will be required to act generally under the supervision of the Clerk of the Council.

Candidates must be not less than 24 Years nor more than 40 Years of Age.

The Salary will commence at the rate of £120 per annum.

Applications, accompanied by *copies* of not more than three Testimonials of recent date (which will not be returned), to be forwarded to the undersigned not later than Saturday, the 9th of February, endorsed "Clerk."

Canvassing the Members of the Council, either directly or indirectly, will be a disqualification.

C. COLE,
Clerk to the Council.

Town Hall, Earlestown,
Lancs., Jan. 21, 1901.

THE Moreton-in-Marsh Gas and Coke Company, Limited, have several Barrels of TAR and AMMONIA WATER to dispose of weekly.

Write, with Offer, to the SECRETARY, Mr. A. W. Drury.

RETORT-FITTINGS of six Beds TO BE SOLD cheap to clear Site. Tangye Mouthpieces, in excellent condition. Hydraulic Main, Ascension-Pipes, &c. Can be seen at work, and put on rail, Harwich.

Apply to J. & H. ROBUS, 20, Buckersbury, LONDON, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY Gas Engineer, Thornhill, DEWSBURY.

A SET of Four Second-Hand Purifiers wanted, with an area of not less than 190 feet each.

Offers, with full Particulars, to be sent in the first instance to No. 3603, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO BE LET on Hire—

PULSOMETER, Size No. 5, with 4-in. suction and 3-in. delivery. Steam-Pipe ¾ in. diameter. Discharge 10,000 Gallons per hour.

TO BE SOLD—

EXHAUSTER for 63,000 feet per hour, with Steam-Engine, by Gwynne. In excellent condition. Replaced by 200,000 feet.

Write J. WRIGHT, Bridge House, BLACKFRIARS BRIDGE, E.C.

CLACTON URBAN DISTRICT COUNCIL.

THE Gas and Water Committee of the above Council are prepared receive TENDERS for the Manufacture and Delivery of about 50 Tons of CAST-IRON PIPES and CONNECTIONS.

Copy of Specification and Form of Tender may be obtained from the Engineer, Mr. Sydney Francis, Town Hall, Clacton-on-Sea.

Sealed Tenders, endorsed "Tender for Pipes," to be delivered to the undersigned not later than Twelve o'clock noon, on Monday, Feb. 4, 1901.

The Committee do not bind themselves to accept the lowest or any Tender.

GEO. T. LEWIS, Clerk.

Town Hall Buildings,
Clacton-on-Sea, Jan. 25, 1901.

MANCHESTER CORPORATION.
(GAS DEPARTMENT.)

STEEL CONDENSING-MAIN.

THE Gas Committee are prepared to receive TENDERS for the supply, delivery, and erection at their Gaythorn Station, of a STEEL CONDENSING-MAIN, together with the STRUCTURAL IRONWORK for supporting same, and ROOF COVERING.

Drawings may be seen on application to Mr. J. G. Newbigging, C.E., Engineer, at his Office, Rochdale Road Station, and Specification and Bill of Quantities obtained on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.

Tenders, endorsed "Condensing-Main," and addressed to the Chairman of the Gas Committee, to be delivered at the Gas Office not later than Ten a.m., on Wednesday, the 6th of February, 1901.

By order,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
January, 1901.

MANCHESTER CORPORATION GAS-WORKS.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the purchase and removal, on the Sliding-Scale Basis, of the GAS TAR to be produced at their Gaythorn, Rochdale Road, and Bradford Road Stations respectively during a period of One, Two, or Three Years, commencing from noon on the 31st of March, 1901.

The Committee reserve the right to divide the Tenders as they may consider advisable.

Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Tar," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 28th day of March, 1901.

Full Particulars may be obtained on application in writing to Mr. Charles Nickson, Superintendent of the Department.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
Jan. 18, 1901.

MANCHESTER CORPORATION GAS-WORKS.

SPENT OXIDE.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the purchase and removal of the SPENT OXIDE, to be produced at their Gaythorn, Rochdale Road, and Bradford Road Works respectively during a period of One Year from the 31st of March, 1901.

The Committee reserve the right to divide the Tenders as they may consider advisable.

Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Spent Oxide," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 28th day of March, 1901.

Forms of Tender and further Particulars may be obtained on application in writing to Mr. Charles Nickson, Superintendent of the Department.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
Jan. 18, 1901.

MANCHESTER CORPORATION GAS-WORKS.

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the Manchester Corporation are prepared to receive TENDERS for the purchase and removal of the TAR and AMMONIACAL LIQUOR, to be produced at their Droylsden Station during a period of One, Two, or Three Years from the 31st of March, 1901.

The Committee reserve the right to divide the Tenders as they may consider advisable.

Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Tar and Liquor, Droylsden," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 28th day of March, 1901.

Forms of Tender and further Particulars may be obtained on application in writing to Mr. Charles Nickson, Superintendent of the Gas Department.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
Jan. 18, 1901.

MANCHESTER CORPORATION GAS-WORKS.

AMMONIACAL LIQUOR.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the purchase and removal of the AMMONIACAL LIQUOR to be produced at the Gaythorn, Rochdale Road, and Bradford Road Gas-Works, during a period of One, Two, or Three Years, commencing at noon on the 31st of March, 1901.

The Committee do not bind themselves to accept the highest or any Tender.

Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Ammoniacal Liquor," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 28th day of March, 1901.

Forms of Tender and further Particulars may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent of the Department.

A deposit of One Guinea (which will be returned on receipt of the Tender) must accompany each application for a Tender Form.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
Jan. 18, 1901.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Friday, the 8th day of February next, at Twelve o'clock noon precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 31st day of December last; and to elect Directors and Auditors in the place of those who will at such Meeting go out of Office in compliance with the Company's Acts or Schemes of Amalgamation.

Notice is Hereby also Given, that, pursuant to the Standing Orders of both Houses of Parliament, an EXTRAORDINARY GENERAL MEETING of the said Proprietors will be held at the same Office immediately after the said Half-Yearly Ordinary General Meeting, when a Bill to be introduced into Parliament, intituled "A Bill to enable the Gaslight and Coke Company to raise Additional Moneys and to Purchase, Take and Hold Lands, and for other Purposes," will be submitted to the Proprietors then present, either in person or by proxy, for their approval.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Jan. 21, 1901.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is Hereby Given, that an EXTRAORDINARY MEETING OF THE PROPRIETORS OF THE SOUTH METROPOLITAN GAS COMPANY will be held at the Cannon Street Hotel, in the City of London, on Wednesday, the 13th day of February next, at 2.30 o'clock in the afternoon, or so soon thereafter as the business of the ORDINARY MEETING of the Proprietors shall be concluded, for the purpose of considering the Provisions of the Bill now before Parliament, intituled "A Bill to Empower the South Metropolitan Gas Company to Raise Additional Capital, and to Purchase by Agreement so much of the Southern Portion of the Undertaking of the Gaslight and Coke Company as is Situate in the County of London, South of the Thames, and for other Purposes."

At such Meeting, the said Bill will be submitted for the consideration and approval of the Proprietors.

Dated this 26th day of January, 1901.

By order,
FRANK BUSH,
Secretary.

Offices: 709A, Old Kent Road, S.E.

CRYSTAL PALACE DISTRICT GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Albion Tavern, Aldersgate Street, London, E.C., on Friday, the 15th day of February, 1901, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 31st day of December last, to declare a Dividend for the same period, to elect two Directors and one Auditor in the place of those retiring by rotation, and one Auditor in the place of Mr. A. G. Hounsham, deceased, and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from the 1st day of February, until after the Meeting.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Offices and Works:
Lower Sydenham, S.E.,
January, 1901.

PATENTS, DESIGNS, AND TRADE MARKS, 1883 TO 1888.

NOTICE is Hereby Given that Augustus HENRY GRAUTOFF, of 8, Fenchurch Buildings, London, has APPLIED FOR LEAVE to FURTHER AMEND the SPECIFICATION of Letters Patent No. 20,740, of 1898, granted to WILLIAM PHILLIPS THOMPSON for "Improvements in, and in the Manufacture of, Incandescent Mantles."

Particulars of the proposed Amendment were set forth in the "Illustrated Official Journal (Patents)," issued on the 23rd of January, 1901.

Any person, or persons, may give Notice of Opposition to the Amendment (on Form G), at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

C. N. DALTON,
Comptroller-General.

HASELTINE, LAKE, AND CO.,
46, Southampton Buildings,
London, W.C.
Agents for the Applicant.

BRENTFORD GAS COMPANY.

SALE BY TENDER OF
£46,875 FOUR PER CENT. PERPETUAL
DEBENTURE STOCK.

IN PURSUANCE OF THE BRENTFORD GAS ORDER, 1881.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £46,875 FOUR PER CENT. PERPETUAL DEBENTURE STOCK of the Company, to be paid up in full on or before the 21st day of February next, such Stock being the amount authorized to be raised by Resolution passed at an Extraordinary Meeting of Proprietors held on the 10th day of August, 1900, under the powers of the above-mentioned Order.

Particulars and Conditions of Tender may be obtained on application at this Office; and sealed Tenders must be sent in not later than Twelve o'clock (noon) on Thursday, the 31st of January, 1901.

By order,
WILLIAM MANN,
Secretary.

Office: Brentford Gas Company,
Brentford, Jan. 5, 1901.

BOROUGH OF WALSALL.
(Gas Department.)

THE Gas Committee of the Corporation of Walsall invite TENDERS for the undermentioned WORKS and MATERIALS in accordance with Specifications and Drawings prepared by Mr. B. W. Smith, the Gas Engineer to the Corporation.

Contract No. 7—For making, supplying, and erecting at the Pleck Gas-Works, Walsall, Eight PURIFIERS on "Green's" System, with Lifting Gear, Valves, Mains, and Connections, and for the construction of a REVIVIFYING-HOUSE, with Iron Roof.

Contract No. 8—For the making, supplying, and erecting at the Pleck Gas-Works, Walsall, of an OXIDE CONVEYING AND ELEVATING PLANT.

Copies of the Specifications and Drawings and Form of Tender can be obtained from the Engineer, Mr. B. W. Smith, at the Pleck Gas-Works, Walsall, on payment of £3 3s. in respect of each Contract, which will be returned on receipt of a *bonâ-fide* Tender.

Tenders, sealed and marked outside as the case may be—

"Tender for Purifiers, &c., Contract No. 7,"
"Tender for Conveying and Elevating Plant, Contract No. 8,"

are to be sent to the undersigned on or before Saturday, the 16th of February next.

The Committee do not bind themselves to accept the lowest or any Tender; and they will not accept the Tender of any Person or Firm paying less than the Standard Rate of Wages current in the District.

By order,
John R. Cooper,
Town Clerk.

Walsall, Jan. 22, 1901.

CITY OF LINCOLN.
Corporation Water-Works.

TO WELL SINKERS.

THE Water-Works Committee of the Corporation of Lincoln invite TENDERS for the construction of a DEEP BORING, to be carried out at the Corporation Water-Works, Boultham, near Lincoln, for the purpose of obtaining a supply of Water from the Bunter Beds of the New Red Sandstone.

Copies of the Specification, Section, and Forms of Tender, together with all available Information, can be obtained at the Offices of the Engineer, Mr. Percy Griffith, Assoc.M.Inst.C.E., F.G.S., 54, Parliament Street, Westminster, or of the Water-Works Engineer, Mr. John H. Teague, Corporation Offices, Lincoln, upon payment of a sum of Five Pounds, which will be returned on the receipt of a *bonâ-fide* Tender.

Tenders must be delivered in the proper sealed Envelopes, endorsed "Tender for New Boring," at the Office of the Deputy Town Clerk, 5 and 6, Bank Street, Lincoln, not later than Twelve noon on Monday, March 4, 1901.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
W. T. Page, Jun.,
Deputy Town Clerk.

Lincoln, Jan. 16, 1901.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards' Offices, 18, Finsbury Circus, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 500 £10 NEW ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Feb. 4, at Two o'clock, in Lots.

Particulars of the Auctioneer, 18, Finsbury Circus, E.C.

GAS AND WATER STOCKS AND SHARES
IN THE
GREAT YARMOUTH WATER-WORKS COMPANY,
GORING AND STREATLEY DISTRICT GAS AND WATER COMPANY, and
SOUTH-WEST SUBURBAN WATER COMPANY.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, the 4th of February, at Two o'clock, in Lots.

Particulars of the Auctioneer, 18, Finsbury Circus, E.C.

SUNDERLAND AND SOUTH SHIELDS WATER COMPANY.

IMPORTANT SALE
OF
WATER STOCK.

TO BE SOLD by Auction in the Long Room of the Queen's Hotel, Fawcett Street, Sunderland, on Thursday, the 21st of February, 1901, at Two o'clock in the Afternoon prompt,

Mr. ATKINSON GIBSON, AUCTIONEER,

£15,000

(Nominal) of the NEW STOCK (Maximum Dividend 5 per cent.) authorized to be created and issued under the powers contained in the Sunderland and South Shields Water Act, 1891.

The above Stock will be entitled to Dividend from the 1st day of January, 1901, and be registered in the name of the Purchaser free of charge.

A Deposit of 10 per cent. will be required at the time of Sale; the remainder to be paid on or before the 1st day of March, 1901.

NITRATE of Thorium and Cerium. Fabrik Chemischer Praeparate von Strahmer, Noack, and Co., Hamburg.

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TRANSPORTABLE
AUTOMATIC GAS-LIGHTERS & MANTLES.

OBERFELT & CO., Berlin, Sandmannshof.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.
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Telegrams: "DARWINIAN, MANCHESTER."
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Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
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PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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per 7/6 Doz.
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THORNLEY GAS COALS
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OUT OF THEIR
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Analysis made by
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Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 „
Ash	2·73 „

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

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Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, near DEWSBURY.

HYDRAULIC BLOWER
For blowing Air into Gas Purifiers for the purpose of
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Full Particulars on application.
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London Office:
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Yield of Gas per Ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

As per Analysis by
Mr. JOHN PATTINSON, F.I.C., F.C.S.

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Highest Results in Gas, & Excellent Coke.

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LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

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Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power $16\frac{7}{10}$ Stand. Sperm Candl.
Coke (of good & pure quality) $13\frac{3}{4}$ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

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Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

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Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

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ALSO
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Yield of Gas per ton . . . . 13,155 cub. ft.
Illuminating Power . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . 10,500 cub. ft.
Illuminating Power . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . 10,500 cub. ft.
Illuminating Power . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

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COAL OWNERS, NEWCASTLE-ON-TYNE
OR
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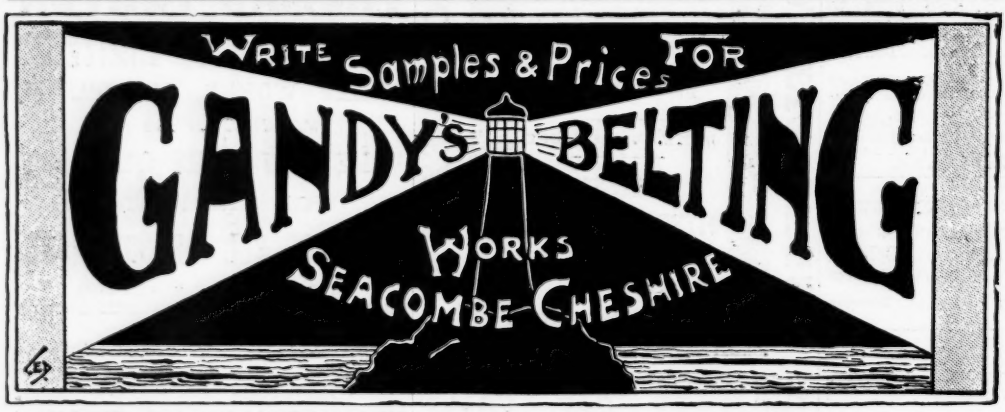
21, JOHN STREET, ADELPHI, LONDON, W.C.



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AS USED BY THE LEADING GAS AND WATER COMPANIES.

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Proprietors of
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ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·80.
VERY FREE FROM IMPURITIES.

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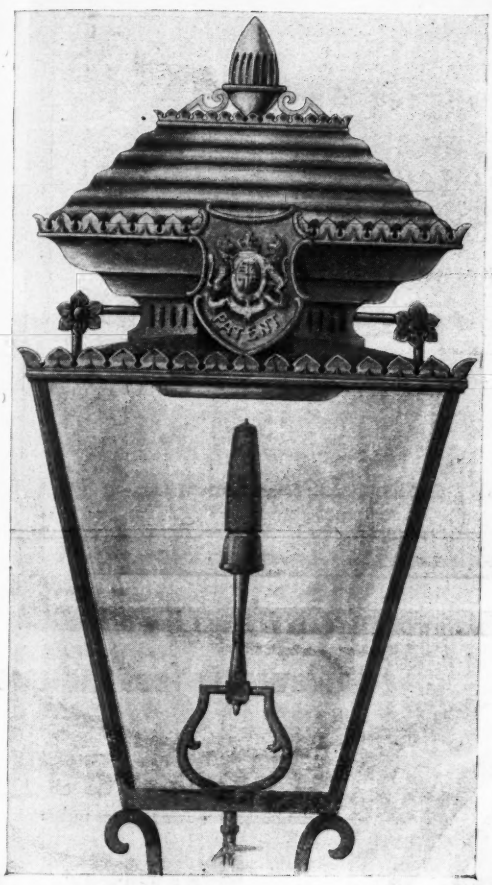
SELF-INTENSIFYING LAMP.



SIZE NORMAL.

Automatic Action.

No Complex Mechanism.

"Power" Free of Cost.

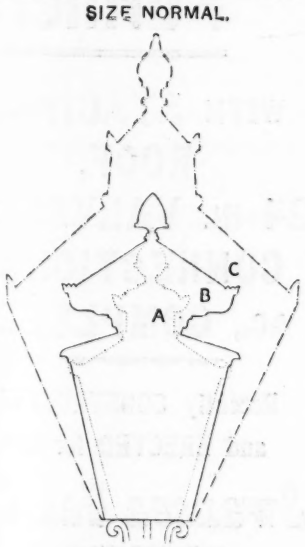
INTENSIFIED LIGHT

WITHOUT Compressing Plant, Special Gas-Service, Water Bill, Gas-Engine or other Pumping Appliances, tearing up of Roadways, or interference with existing Service.

The **SCOTT-SNELL LAMP** may be set to give any pressure from **4 inches to 36 inches of Water**; **8 inches to 10 inches is usually preferred.**

400-*CANDLE POWER OBTAINED FROM A SINGLE BURNER.*

Lanterns supplied with Single, Duplex, or Cluster of Burners.



SCALE DIAGRAM.
A. Ordinary 16 inch Street Lamp.
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C. Ordinary Refuge Lamp.

HIGH-PRESSURE LIGHTING HAS COME TO STAY.

Orders for Trial Lamps will, as far as possible, be executed in rotation.

The Lamps are being made by Automatic Machinery, similar parts interchangeable, minimum of hand labour.

THE LAMPS MAY BE INSPECTED AT ANY TIME BY APPOINTMENT.

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Works: 29, GILLINGHAM STREET, S.W. **WESTMINSTER, S.W.**

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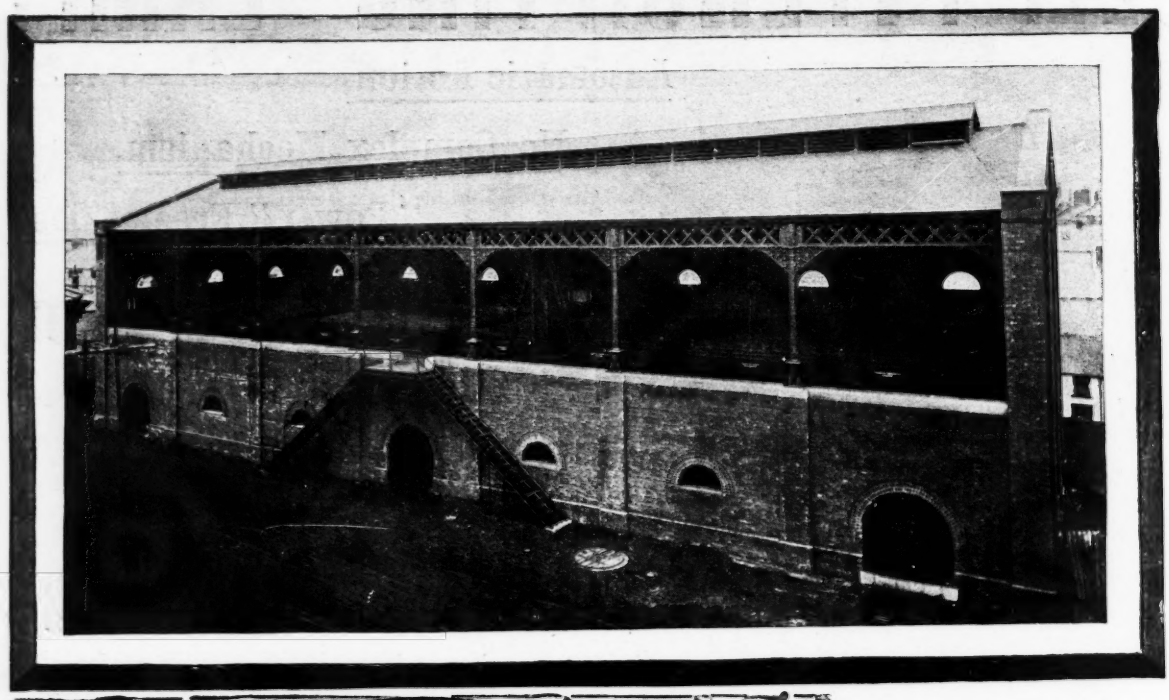

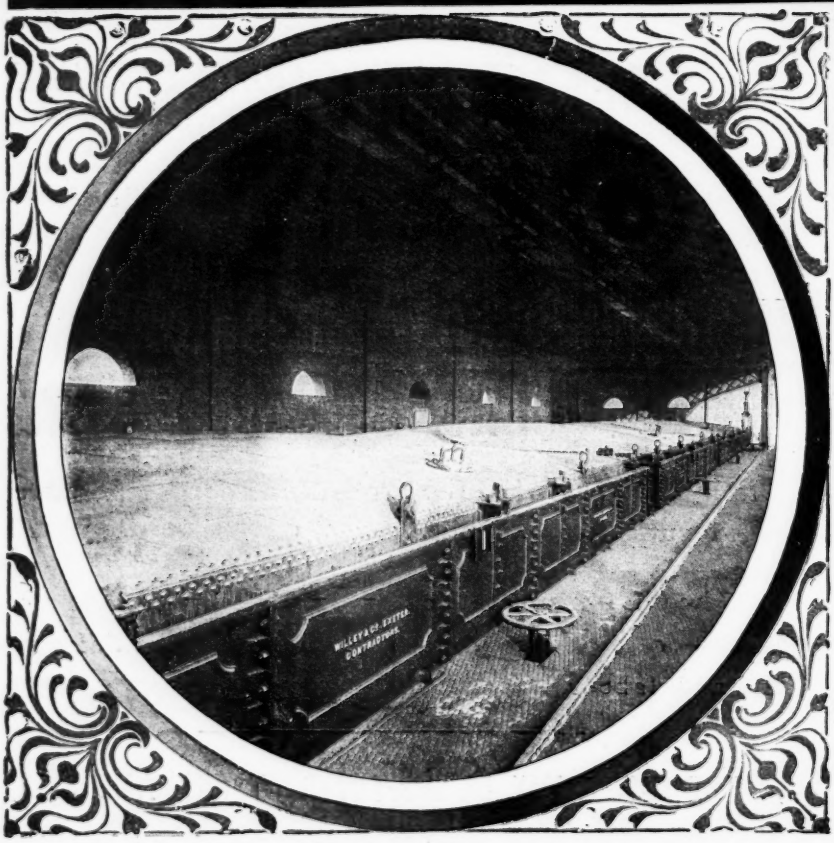

New 30 feet Square

Overhead

Purifiers

WITH STAGING, ROOF, 24-IN. VALVES & CONNECTIONS, &c., COMPLETE.

Recently CONSTRUCTED and ERECTED for the

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To the Design of
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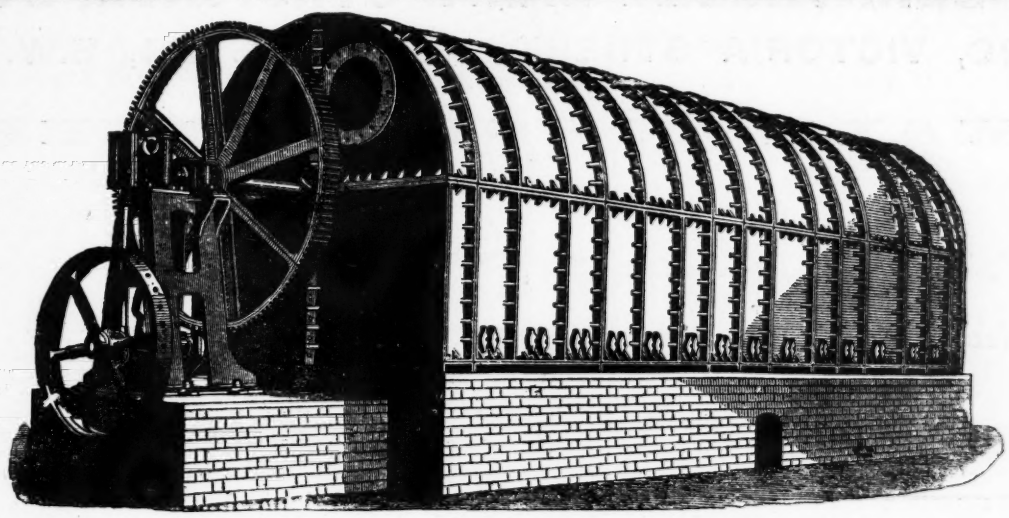
PLYMOUTH, DEVONPORT, SWANSEA, & NEWPORT.

H. KIRKHAM'S PATENT "IMPERIAL" WASHER-SCRUBBER.



TESTIMONIALS.

The Dover Gaslight Company,
Gas-Works, Buckland,
Dover, Feb. 8, 1899.

H. KIRKHAM, Esq.,

Dear Sir,—Have now made further tests with the Washer fitted with your PATENT WASHING DEVICES, and have much pleasure in reporting that *the results were highly satisfactory*; also, I ascertained that the maximum results were obtained when the machine was working at three revolutions per minute. At this speed 13 to 14 gallons of water per ton of coal carbonized were converted into 10-oz. Ammoniacal Liquor, and at same time the Gas was free from Ammonia.

Should you wish further details, I will forward them.

I am, dear Sir, yours truly,
RAPHAEL HERRING, Engineer.

The Dover Gaslight Company,
Gas-Works, Buckland,
Dover, April 4, 1900.

Re H. KIRKHAM'S PATENT WASHER.

Please note I have much pleasure in stating that one of the above Patent Washers, 1,000,000 cubic feet capacity per 24 hours, has now been in regular action day and night for about 18 months, and is still working to our entire satisfaction.

Six months ago I examined the interior, and then found the Scrolls clean and bright, due, in my opinion, to the flushing action of the fluid rushing from inside the Scrolls.

Also when passing its maximum quantity of gas it gives the minimum of pressure.

For further Particulars see my report to Mr. H. Kirkham, Feb. 8, 1899.

Yours truly,
RAPHAEL HERRING, Engineer.

The Dover Gaslight Company,
Gas-Works, Buckland,
Dover, Dec. 29, 1900.

H. KIRKHAM, Esq.,

Dear Sir,—Your Washer fitted with Patent Scroll Devices was put to work Nov. 9, 1898, and has been in regular use to this date.

I am sure you will be pleased to know that the excellent results we got when this was first started are still regularly obtained.

Yours truly,
RAPHAEL HERRING.

EFFICIENCY GUARANTEED.

Estimates given for a complete set of Segments for One Wheel, or for refitting the whole number of Wheels in a Machine; also for Washer-Scrubbers complete.

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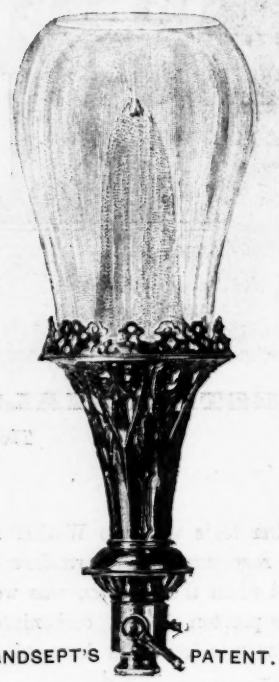
THE DENAYROUZE LIGHT SYNDICATE, LTD.,

28, VICTORIA STREET, WESTMINSTER, S.W.

SMALL TORCH BURNER.



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Consuming 3½ Cubic Feet of Gas per Hour.

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Burner with Mantle, 4s.

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Extra Mantles 4s. 6d. per dozen.

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SPECIAL BRICKS and BLOCKS of every description for GENERATOR and REGENERATOR FURNACES.

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Large Stocks of Bricks of all sizes, Burrs, Boiler Seating Blocks and Covers, Plain and Rebated Tiles, &c., &c.

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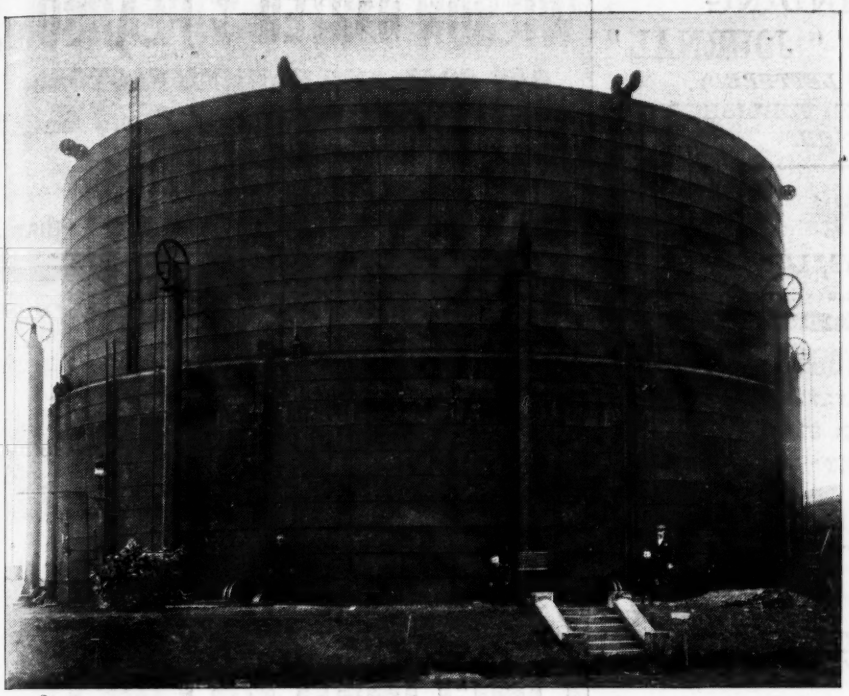

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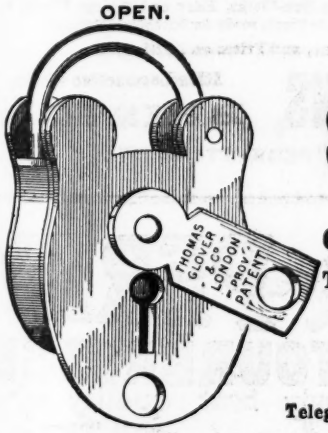

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PREVENTS TAMPERING WITH THE

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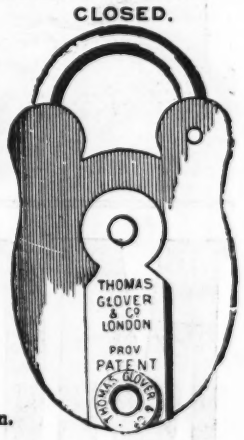

Telegraphic Address: "GOTHIC, LONDON." Telephone No. 725, Holborn.

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SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS
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Patent Automatic Machinery
FOR
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Full Particulars may be obtained from the Sole Makers,
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Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
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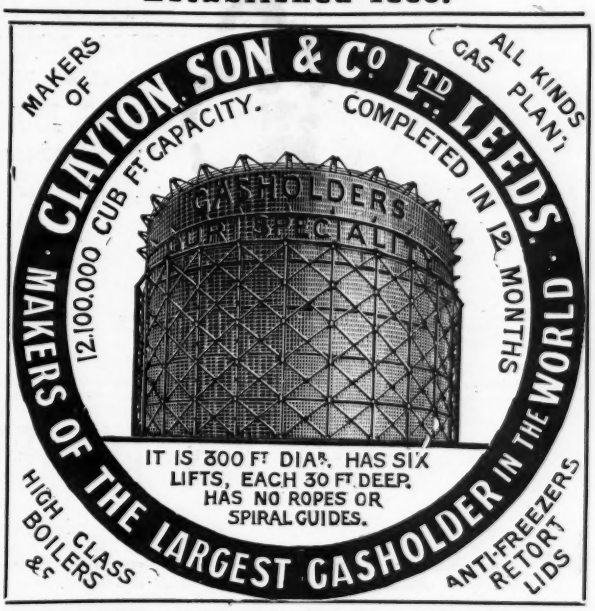
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